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EMPIRE DEVELOPMENT.

THE Mansion House, situated in the heart of the world's metropolis, has been the scene of many brilliant functions, and many an eloquent appeal has been voiced within its walls for a variety of worthy causes. On January 29, 1925, a distinguished body, truly representative of the wide flung domains of the British Empire, listened to an appeal by eminent statesmen on behalf of an Imperial venture which is likely to have an important re-action upon the development of the British Tropics, and with it the whole British Empire. Few people in the temperate zones, particularly in the United Kingdom, realise the extent of their dependence upon the tropics for many of the so-called necessaries and luxuries of life. These regions of the world constitute an "Empire in Trust" for the development of which the United Kingdom has made itself responsible, and it was on behalf of The Imperial College of Tropical Agriculture, an institution which is destined to play a large part in the development of these areas, that this Imperial body was gathered together.

A report of the speeches by the Rt. Hon. L. S. Amery, M.P., Secretary of State for the Colonies, Sir Arthur E. Shipley, G.B.E., F.R.S., (Chairman of the Governing Body of the Imperial College of Tropical Agriculture) and the Right Hon. the Viscount Burnham, C.H. (Chairman of the Appeal Committee of the Imperial College of Tropical Agriculture), will appear as a supplement to the May issue of "*Tropical Agriculture.*" The tropical portions of His Majesty's Dominions consist in the main of areas only partially commercially developed and inhabited by natives in various stages of civilisation. These regions are dependent almost wholly upon agriculture for their prosperity, and development must necessarily imply an improvement of scientific agricultural methods. For this purpose a body of trained agricultural advisers, administrators, and managers is essential. In the past Great Britain has "muddled" through with conspicuous success chiefly owing to the brilliant foresight of individual British men and Companies. The way of the pioneer is a noble one but usually hard upon the pioneer. Great Britain has suffered the heat and the burden of the day in tropical development and other countries, entering the field at a later stage, have profited by her expensive failures. The cool, calculating, comprehensive policies of foreign countries and the stress of modern competition have dealt a death blow to the policy of "muddling." That eminent statesman, Mr. Joseph Chamberlain, was one of the earliest to recognise and to voice this sentiment and to his inspiring example and indomitable courage we owe the inauguration of that campaign of constructive Imperialism which has since been continued in various guises by Parties of every political complexion.

We have no hesitation in saying that the country which in the future controls the Tropics controls the world. The Tropics are important not only as suppliers of raw materials, vital to the needs of the manufacturing centres of the Temperate Zones, and as sources of food supplies to meet the wants of factory operatives, but also as potential markets for the manufactured articles of these industrial centres. Development must proceed upon sound scientific

agricultural lines and the country which possesses the most competent body of scientifically trained agriculturists is well on the road to securing the control of the Tropics. It was for the purpose of training these men that the Imperial College of Tropical Agriculture was founded with Imperial support. That His Majesty's Government is fully alive to the possibilities of the College is evinced by the statement of the Secretary of State for the Colonies that "both opportunities and inducements should be given to our future agricultural officers to begin with a full course of training at the Imperial College." Four probationary agricultural officers appointed to the Gold Coast are now undergoing training at the College and form the forerunners of what must become an ever increasing body of agricultural officers. Evidence that the significance of the College is appreciated by other bodies is shown by the fact that the Empire Cotton Growing Corporation has sent a number of its officers here for practical training before taking up their substantive posts in tropical areas. Past students are now at work in Nyasaland, Uganda, Antigua and Colombia. Nor is appreciation confined to the British Empire for enquiries have been received from foreign countries and one foreign student is already undergoing training at the College. The advantage secured by such training, under conditions similar to those in which the students will eventually take up appointments, is obvious. In addition to offering facilities for training on the various spheres of tropical agriculture, the College possesses the only model experimental and instructional cane sugar factory in the Empire, in which students can receive training in every branch of sugar factory control.

As the number of students increases so the sphere of influence of the College will expand. The British Empire has emerged battered but victorious from a world conflict of unparalleled severity. She is now engaged in a commercial struggle all the more insidious because of the absence of those spectacular feats of bravery which characterised our armies in the field. The outbreak of the Great War found the British Empire unprepared for hostilities. Signs are not lacking that the Empire is gradually emerging from the slough of inertia and bending her energies to a solution of those problems with which it is confronted and it is to be hoped that the eloquent appeals for all institutions, such as the Imperial College of Tropical Agriculture, which are capable of playing an important rôle in this struggle for commercial supremacy, will not fall upon deaf ears. The day of small economic units has passed and the Empire must stand or fall as a whole. The Imperial College of Tropical Agriculture can play an important rôle in Empire development and its influence is at present limited solely by its inadequate funds. The College stands for Empire development and it is to be hopde that the Empire will assist in no niggardly manner.

FORESTRY AND AGRICULTURE.

The Allocation of Land.

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Conservator of Forests, Trinidad and Tobago.

MANWOOD, in his treatise on "The Lawes of the Forest," 1598 defines a forest as follows "A forest is a certain territory of woody grounds, fruitful pastures, privileged for wild beasts and fowls of forest chase, and warren to nest and abide in, in the safe protection of the King for his princely delight and pleasure, which territory of ground, so privileged, is meered and bounded with unremovable marks, meers and boundaries, either known by matter of record or else by prescription."

This definition with its pleasing old world flavour is, however, hardly applicable to modern conditions and for the purpose of this article a forest may be treated as it is regarded in popular opinion, *i.e.*, as an area more or less (chiefly more) covered with trees. Inasmuch as forestry and agriculture are both based on the yield capacity of the soil, questions arise periodically as to whether certain areas should be allocated to forestry or to agriculture. A correct appreciation of the various factors governing the answer to the above question although, unfortunately, very often lacking, is of decided importance in affecting the welfare of the community. Instead of merely asking "is this land suitable for growing coffee, or sugar-cane, or cotton or tea or cocoa, &c., &c.," a sounder policy would first dictate consideration of the question, "is this land more suitable for agriculture or forestry?" The utility of agriculture is so far more self-evident than the utility of forestry that the case for forestry often goes by default. Before proceeding further it is therefore well to examine briefly the various ways in which forests are of utility, both directly, through the production of timber and various other products and indirectly, through the influence they exert on what may, somewhat generally, be described as climatic conditions. It is convenient to deal with the latter first.

The indirect utility of Forests.

Popularly, forests are supposed to increase very decidedly the rainfall and this question has been actively discussed for years past. The following evidence quoted from Schlich's "Manual of Forestry" Vol. I. (1922), is therefore of interest.

"(1) Ebermayer's observations in Bavaria, started in 1867 and carried out with great care, do not justify any final conclusion as to an increase of the rainfall due to the action of forests. He states that in the plains the effect of forests is certainly very small, but that it increases with elevation.

(2) Extensive observations made in Sweden, on 400 stations during a period of 15 years, show that the difference between parts of the country with 56 per cent. of the land under forest and those with only 17 per cent. under forest is certainly not more than 3 per cent. increase in favour of the former.

(3) The Government of India has during late years investigated the subject, and the results obtained do not justify any direct conclusions beyond the fact that, if forests influence the rainfall at all, the effect is insignificant."

It would seem, therefore, as if yet another popular fallacy must be disclosed—many popular opinions, however, while erroneous as they stand, often contain a grain of truth and if for rainfall, be substituted "effective rainfall" the subject is changed to the conservation of water, on which forests have a profound effect. It is also probable that whereas forests are the result and not the cause of rainfall, nevertheless various physical factors react towards rendering forests condensers of water vapour and thus producing small local precipitations.

The question cannot yet be considered as definitely closed. Having removed a claim for forestry which, though often made, is at least somewhat difficult to substantiate, it is now possible to consider briefly the effect of forest growth on factors which affect agricultural interests.

The temperature in forests is lower during the day and slightly higher during the night than on open ground, the mean annual temperature being slightly lower. This effect, owing to constant interchange of air is communicated to the surrounding country, the effect of course varying with the distance and the extent of the forest. Observations too, have shown that the relative humidity of forest air is greater than that of air in the open, the effect being mainly due to temperature; near the 50th degree of northern latitude the increase was found to vary from about 5 per cent. in winter to 9 per cent. in summer.

The air being relatively somewhat moister and the temperature a little lower it follows that passing clouds would tend to have their moisture precipitated especially as the trees obstruct air movement. In this way local precipitation referred to above, may be produced: on the other hand rain depends more on agencies such as the presence or otherwise of large sheets of water, mountain ranges, &c., by comparison with which the influence of the forest is but small. The relative humidity of the air being increased, it follows that evaporation from the soil tends to be less in and near to forests, than on open ground and thus on the whole it may be safely stated that forests preserve humidity to a considerable extent. Especially so is this true of mountain forests which from time immemorial have been regarded as the natural preservers of moisture.

To complete this brief survey of the indirect utility of forests it is necessary to refer to what may be termed the mechanical effect of forest growth—possibly its most important effect. A forest may be compared to a piece of blotting paper. If a drop of water is allowed to fall on a piece of blotting paper held at a slope the water will be absorbed; for the blotting paper substitute a piece of glossy paper and the water will run off. So it is with forested and bare land respectively. When heavy rain falls in the forest the mechanical force of the rain is largely broken by the trees and shrubs—so much so that in a dense forest most of the water reaches the soil either by dripping from the twigs and leaves or by running down the trunks of the trees. The surface soil in a forest consists of humus—decaying organic matter capable of absorbing large quantities of water. It is, in fact really a colossal vegetable sponge capable of holding many times its own weight of water. When rain falls it is absorbed by this sponge and gradually given off to the mineral soil beneath passing out eventually as springs which yield a steady source of supply to streams and rivers. If on the other hand the forest cover be injudiciously removed a very different state of affairs is liable to be set up. A tropical rainstorm falling on a comparatively bare hill-side instead of being absorbed, can be the direct cause of floods, erosion and landslips. Referring again to the investigation which the Government of India instigated on the effect of forests on atmospheric and soil moisture it is important to note that the Government of India arrived at the conclusion that "the denudation of the soil, owing to the destruction of forests, might, as far as India is concerned, be looked upon as an established fact." The importance of this statement to the agriculturist is, perhaps, so obvious, that it has tended to be overlooked. The mountain forest is, in brief, the natural regulator of stream flow, both preventing floods and consequent erosion during the rains and, from the underground reservoirs providing a steady flow during the dry season. Once this fact is fully realised it is unnecessary to labour certain obvious corollaries. It may not, however, be out of place to refer to the benefit of a pure and steady supply of drinking water such as is supplied by streams which rise and flow through forested country and also to the steady development of hydro-electric power which yearly is receiving more and more attention throughout the civilised world. So much for hill forests. Forests in the plains come under a different category, their value here being primarily as windbreaks. The protection afforded to agricultural crops by well located windbreaks is a question which might well receive more attention. Apart from windbreaks lessening damage from the mechanical force of the wind, the drying up of the soil is, on the whole, more influenced by wind than by sun and varies with the velocity of the wind. By a judicious arrangement of windbreaks conditions approximating to those which obtain in sheltered valleys may be brought about—an asset, the value of which is none the less real because it is difficult to reduce it to pounds, shillings and pence. Although the question of erosion has been dealt with very briefly it is, in practice, one of the worst evils resulting from unwise deforestation and the space devoted to this subject is no criterion of its importance; the action of the roots of trees in binding together the soil and preventing landslips and controlling shifting sands should also be noted. Having thus briefly reviewed some of the more outstanding indirect utilities of forestry it is possible

to return to the question propounded at the commencement of this article, *i.e.*, the allocation of land to forestry or to agriculture. It is hoped that it is clear from the foregoing that, depending primarily on topographical considerations, there are certain areas which it is advisable should be retained under forests. Very often by their very nature, however, such forests are located in inaccessible places and it may often happen that, such being the case, they are not suited for the economic marketing of their various products.

The direct utility of Forests.

Forests produce timber (including pulpwood) and firewood as well as a variety of minor products such as barks for tanning, cork, turpentine, various dyestuffs, gums, oils, &c.—incidentally in 1913 the import of these minor products into the United Kingdom was valued at over £27,000,000. Agriculture, normally, needs first consideration from the point of view of food production, but timber and firewood cannot be overlooked and provision must be made for them. In the past the forest resources of the world have been regarded as illimitable and it is only in recent years that investigations into the world stock of timber have shown that the position as regards timber supply is already serious and is likely to grow still more so. In other words the time has come, is in fact, overdue, when unchecked forest destruction must cease and more attention be paid to keeping certain areas under properly managed timber crops. Fortunately trees are, on the whole, far less exacting in their soil requirements than are agricultural crops and can be grown successfully on areas which are really unsuitable for agriculture. On such areas, in fact, forestry is usually a more profitable undertaking than agriculture, *i.e.*, yields a higher net rental of the soil. In countries where forestry has reached beyond the forest protection stage and forests are properly managed, yield tables are available and from them it is possible to work out the average annual return which may be expected from an acre of forest land. The necessary formula being as follows :—

$$\text{Soil rental} = \left(\frac{Yr + Ta \times I^{r-a}op + \ldots\ldots + Tq \times I^{r-q}op - c \times I^{r}op}{I^{r}op - I} - E \right) \times op$$

where r=rotation.
Yr =value of final yield.
Ta =value of thinning at age a.
c =cost of formation.
E =capitalised value of annual expenses.
p =rate of interest.

The above formula may, for example, be assumed to work out at 18*s.* net an acre and unless at least this sum can be anticipated from agriculture it is clearly preferable to grow timber ; incidentally, a similar formula is made use of by the Forestry Commission in England. Many estates to-day have fields under agricultural crops to which they are quite unsuited and it is not too much to say that the attention which has to be devoted to these poor soil areas absorbs all the profits from the truly agricultural lands. Of course, accurate bookkeeping and costing is necessary to determine doubtful points but in many cases a cursory examination of the soil (not only the surface but down to the depth of a few feet) will give the required information in a very obvious manner. There are thus various poor soil areas on which forestry is a sounder financial proposition than agriculture. It is, however, useless to expect such results unless a correct appreciation of certain fundamental principles of forestry be obtained. Although, on the whole, trees will thrive on soils on which agriculture is not profitable there is a big difference in the conditions and treatment which various species require—even as in England oak thrives on clay, while pines will flourish on a practically pure sand on which no other economic crop can be grown. It is outside the scope of this article to elaborate such first principles as the difference between species which are light demanding and those which will bear shade, but a yield of about 3,000 cubic feet per acre after 50 years or so will not result if trees are merely planted and then left to fend for themselves. On the other hand, if a plantation be formed either of a pure shade bearer or a mixture of a fast growing light demander with a slower growing shade bearer, trees spaced 4, 5, or 6 feet apart, as the case may be, and properly tended until the canopy be formed after a few years, then the plantation, to bring it to a profitable maturity, only requires periodic thinning—a matter, however, of great importance.

Conclusion.

An American publication dealing with the Forests of Porto Rico summarises very aptly many of the foregoing points in the following words : "Every acre of land around the headwaters and along the banks of rivers on which a forest cover would offer a protection superior to the present cover against erosion and soil wastage should be forested. All forested lands and those to be forested should be so managed as to yield a maximum of the products most needed by the local communities and industries. The forestry programme should also provide protection to the birds, live stock, and even man himself in the form respectively, of small groves at intervals throughout the cane and tobacco districts, open cover in the pastures, and shade trees along the roadsides." (*U.S.A. Dept. of Agriculture Bulletin* 354.)

Without agricultural development we cannot even maintain our present state of civilization : and forests, as has been shown, are often of the very greatest indirect assistance to agriculture. As for timber—we had better be without gold than without timber.

SUGAR-CANE VARIETIES.

Some Agronomic Considerations.

PROFESSOR J. SYDNEY DASH, B.S.A.

IT will, I think, be obvious to many who have been following the sugar-cane variety question closely in the last few years, that the time has come when careful stock should be taken of the situation with a view to determining whether the existing practice of turning out varieties as it were almost mechanically, could not in certain ways be modified and somewhat less wasteful methods adopted, with better results. The number raised annually for destruction is enormous and even those which eventually get a trial are more or less short-lived.

I. *Rearing.*—Given favourable climatic conditions, it is the experience of the writer that where the methods of obtaining fertile seed are well known and carefully followed, no great difficulty, horticulturally, attaches to the actual raising of seedling sugar-canes. What is not generally recognized, however, is the fact that if too tenderly treated in their early existence, while a large number of seedlings can be brought to the field stage, comparatively few will show those desirable qualities of vigour and hardiness when the time arrives for a first selection to be made. The suggestion is not that the plants should be neglected in respect to nourishment and ordinary care—heavy rains and careless watering may do much harm—but rather as regards over-shading, constant handling and transplanting. Indeed, this applies to young plants generally, which are often too delicately reared in the tropics. It is significant, in this connection, that such varieties as Bourbon, the Transparent and Tanna canes, whose parentage is unknown and which must have originated under natural conditions, should have survived over a long period and given a greater length of service, than present day varieties artificially raised. Crystallina (White Transparent) is still the cane which produces the bulk of the Cuban crop and, according to recent reports, Ribbon Transparent is again being requisitioned in parts of Louisiana, while the Tanna canes continue to do yeoman service in Pacific countries.

II. *Mother Canes.*—Another consideration to which attention might be drawn is whether it would not be advisable to keep definite areas allotted to mother canes, that is canes which have definitely proved themselves to be above the average as parents even though they themselves may not be deemed worthy of cultivation on a field scale. In the early years of seedling production, Harrison attached some importance to this fact and actually reduced his mother canes to four—Bourbon, White Transparent, Red Ribbon and D. 625. In Barbados and Guadeloupe both, where the writer was occupied for several years with sugar-cane variety work, some canes have always given evidence of being more useful mothers than others. To illustrate this point: it is remarkable that the Barbados seedling 6,835 is a parent of both B.H. 10 (12) and St. Croix 12 (4)—canes of outstanding merit at the present time—although B. 6,835 itself has never occupied a very high place among the leading varieties. With two such canes to its credit, it is reasonable to suppose that others of at least equal value might be obtained from this variety. It would be interesting to learn the experience of other workers in this connection.

III. *Rooting Habits.*—Dealing more particularly with testing and selection, I would urge in future, the necessity of placing greater emphasis on rooting habits. Hitherto, final selection has largely been made on the performance of the above-ground portion of the cane. Uba provides a striking example of the value of a strong root system in determining the lasting and resistant qualities of a variety. Some attention has been given to this question in India, where suitable methods have been devised for the study of cane roots in different soils, and it is not too much to hope that in the final tests of new varieties their under-ground parts will receive more consideration than has been given in the past. Associated with this aspect of the problem and its possible bearing on variety deterioration, is the age which a new seedling should be allowed to reach before cuttings are taken for its first reproduction vegetatively. Here again there is room for careful observation. Doubtless, as soon as our knowledge in these matters is more complete, the more certain will be the results obtained in the work of establishing valuable types, with a greater period of usefulness than those which have been turned out since the discovery of the propagation of sugar-cane by sexual means.

IV. *Costings.*—On the strictly commercial value of a variety, there is room also for considerable economic research. So far, little has been done in this direction. It is difficult for the experiment station, often with limited land facilities, to attempt, and co-operation with the grower would be necessary; I refer to the possibility of determining how varieties compare from the standpoint of sugar production costs. At the present time, varieties are judged largely on the sucrose yield per acre. With high-priced sugar nothing further probably need be considered; with low-priced sugar, the necessity of figuring costs very closely becomes imperative. Obviously, cost accounting studies would have to be made and an accurate, comparative account kept at every stage—in field and factory; for it is clear that some varieties can be more cheaply grown agriculturally than others, while some are more economically handled in the factory, and *vice versa*. It is a question of reconciling the two so that the best financial results may be obtained.

To sum up: an attempt has been made in the foregoing to indicate what would appear to be a few of the more important factors to be considered if progress in sugar-cane variety work is to be maintained and improved. Prominence is being given

to bud selection as a means of improvement within a variety, notably in Hawaii. Its difficulties and limitations are well understood; the problem of sorting out true variations from seasonal or environmental fluctuations requires much patient investigation. In any case, the raising of new varieties must always remain of paramount importance. Little reference has been made to the pest and disease aspect, since it is perhaps the only one—in addition to the chemical and technological side of the industry—which has received the attention it deserves. The Department of Agronomy at the College, now merged into the broader one of Agriculture, is acutely aware of the many problems awaiting solution; it is, however, handicapped at the present time by inadequate land facilities. Nevertheless, about five acres are under sugar-cane and various economic plants and from this beginning it is hoped to rapidly extend variety and other studies as soon as funds are available. In another issue of the Journal it is proposed to give some results of the work already in progress.

THE ZANZIBAR CLOVE INDUSTRY.

More than a hundred years ago the first clove seeds were brought from Mauritius, then the chief clove-growing country. From the foresight of the early Sultans, who introduced a system of forced cultivation of this tree, combined with the destruction by cyclones of the Mauritius plantations, arose the present industry, which provides some 90 per. cent. of the world's requirements. Some 40,000 acres are under cultivation, with an estimated stock of about four million trees. The annual yield varies from about 3,000 tons in a poor year to as much as 14,000 tons in a good season.

The clove of commerce is the dried un-expanded flower bud, gathered just before the flowers expand and when the buds have turned from green to pink. The buds on the stems are gathered from the branchlets of the tree by hand, the pickers climbing the trees or using ladders. The cloves are brought to the drying-ground, where the picker breaks the buds away from the stems, and is paid for his labour by the weight of the green buds. Drying on cement drying floors takes from three to four days in dry weather. Too fierce a sun will cause loss in the essential oil. The dry stems, which, if they receive proper attention, should weigh about 30 lb. to every 100 lb. of dry cloves, have also a commercial value, fetching rather less than a quarter of the price of the latter. "Mother-of-clove" is the mature seed, and of much less value than the clove, with which, however, it is often mixed. Immature cloves, those picked before they are ready or beaten to the ground by wind or rain, are also found in bad samples. They are known to the trade as "Koko" and to the natives as "Mpete." —(*Perfumery and Essential Oil Record.*)

SILANI.

A new cover and forage crop from the Philippines.

Prof. S. C. Harland, D.Sc., F.L.S.

The practice of growing leguminous cover crops in coconut plantations is now widespread throughout the Tropics, and new species of Leguminosae are constantly being brought forward for trial. In this connection the *Sugar Central and Planters news*, Manila, P. Is. of November, 1924, contains an account of the uses of *Vigna marina*, M., both as a cover and forage crop.

Known in the Philippines as Silani the plant is a perennial trailing vine with yellow flowers and small pods of 4 to 7 cm. in length. Seeds are produced somewhat sparingly but the plant may easily be propagated from cuttings.

Silani cut as green forage is readily eaten by stock and possesses a high carbohydrate content which may render it of special value for finishing off cattle before placing them in the market.

An area of about 20 hectares is reported to have been the subject of a successful experiment in the use of Silani as a cover crop. The plants do not tolerate well along dry season but make the best growth where the rainfall is of fairly equal distribution throughout the year.

As previously mentioned, the Silani is a sparse seeder and cuttings must be used for planting the crop on a large scale. Planting should be done during the rainy season using cuttings of about 2 ft. in length. Once the plants are established they make a rapid and vigorous growth, and patches of wild plants have been observed to maintain a thick blanket for four years in full sun exposure.

By a curious coincidence the present writer has had this plant, or one very similar to it, under observation more or less sporadically since 1915. It is common in marshes along the seashore in most West Indian Islands and corresponds with the description of *V. luteola*, Benth. It tallies almost exactly with Wester's description of Silani and a few cuttings planted six months ago spread with extreme rapidity for 15 ft. on either side of the ridge. Mr. Wester's suggestion that hybridization of the perennial Silani with its close annual relative the Cowpea, is not likely to bear much fruit, since experiments in this direction have already been tried. Although several hundred crosses have been attempted, the results have been unsuccessful.

A closely related plant, *Dolichos hosei* of Eastern origin is similar to *Vigna luteola* in general habit of growth, and like this plant produces only a small quantity of seed. Hybrids with the cultivated forms of *Dolichos* have been attempted again without success.

In view of the promising results obtained with Silani as a cover crop in the Philippines, experiments on a larger scale will be conducted in Trinidad where its behaviour will be closely studied.

GOVERNMENT BOTANIC GARDENS.

By Lieut.-Colonel Sir David Prain, c.m.g., c.i.e., ll.d., f.l.s., f.r.s., late Director of Royal Botanic Gardens, Kew and Vice-Chairman of the Governing Body of the College.

[*The following is the second part of the Sir George Birdwood Memorial Lecture delivered before the Royal Society of Arts (Indian Section) by Sir David Prain. The first part of this article was published in the last issue of the Journal.*]

The idea which had guided Aristotle and inspired the rulers of Mexico occurred once more to those English planters in the West Indies who, in 1764, established in the grounds of Government House at St. Vincent a garden stocked with useful and ornamental plants, to illustrate what the West Indian colonies could produce, and to demonstrate what plants of exotic origin might be grown in the West Indies with advantage to the inhabitants. Those who founded this garden were, apparently, actuated by more than an economic purpose ; the designation they gave it indicates that they hoped the new garden might also satisfy scientific curiosity. Their action was but a further instance of that sympathy with the improvement of natural knowledge manifested by West Indian planters when they gave the financial assistance which ensured the publication of scientific treatise dealing with the natural history of Jamaica, Barbados, the Bahamas and Carolina. The well-known works of Sloane, Hughes, Browne and Catesby were prepared in emulation of the more famous ones dealing with the natural history of Malabar and the Moluccas, prepared by servants of the Dutch East India Company. The appearance of these latter works by Rheede and Rumphius had not conveyed to English merchants in the East Indies the lesson they taught English planters in the West Indies. The " scientific curiosity " of the English East India Company in the natural products of its territories, if it existed at all, was more than satisfied by what its Netherlands rival had done. But when English planters in the West Indies went a step further than Dutch merchants in the East Indies had gone, they supplied the two competing Eastern corporations with food for thought. The Dutch East India Company, whose example as regards natural history surveys had been copied in the West Indies, did not pay the latter the compliment of copying at once the West Indian idea of establishing a botanic garden. The English East India Company, which had not thought it necessary to make a survey of the resources of its possessions, followed the example set by the West Indies so far as the establishment of experimental gardens was concerned.

The history of the two great East India Companies affords a clue to these diversities of purpose. The rivalry which marked their careers was the outcome of a community of interest in the products of what were known to classical and renaissance naturalists as " aromatic plants." These plants were often linked with " coronary " ones, much as " esculent plants " were associated with " medicinal " ones. Yet they were less frequently grown in classical gardens than their " coronary " companions ; those best known were common on the hillsides of Greece and Italy, those whose products were most in demand rarely found the climate of the northern Mediterranean seaboard congenial. Supplies of these products reached the ancient world, largely by way of the Red Sea, from the Emporium Aromatum on the East Coast of Africa, or from Western India and the lands beyond that lay " under the wind." Sellers of the " incense " of Zingis and the " spices " of the two Indias were less reticent regarding these commodities than were those who retailed drugs and the " drowsy syrups of the East." But the confusion as to their characters, manifest in classical allusions to " aromatic plants," is as bewildering as the dubiety regarding the qualities of many of the familiar " medicinal " ones. If those who sold " balsams " and " spices " were more communicative, they were even less well informed than dealers in " simples." Perhaps the Oriental middlemen from whom classical merchants derived their supplies did not always tell the same tale or provide articles true to name.

The fall of the Western Empire caused less dislocation of the traffic in Eastern products than it did to most of the activities of the Latin world. If the barbarians who overthrew Rome preferred European foods, they soon developed a taste for Levantine condiments ; the trade in " spices," which flourished during the middle ages, became a Venetian monopoly. It was a wish to break this monopoly that took the Portuguese round the Cape of Good Hope and led them to deprive Arab seamen of the maritime supremacy they had so long enjoyed in the seas beyond the Cape of Currents. It was a resolve to destroy the new monoply that induced the Dutch to follow the Portuguese and deprive them of their mastery of the Indian Ocean. It was a determination to share in the profits of the spice trade that led the Merchant Adventurers of London to form an East India Company of their own. As regards most Indian products the two corporations could buy and sell on fairly equal terms. But as regards the traffic in " cinnamon, nutmegs and cloves," equally coveted by both companies, the Dutch were at an advantage : they had reached the Indies first and had taken over from Portugal the political as well as the commercial supremacy of Ceylon and the Spice Islands. The example set by the West Indies in forming a Botanic Garden at St. Vincent gave the English East India Company a hint which the Dutch East India Company hardly required. The English Company resolved to form a garden in which to naturalise, if possible the " aromatic plants " characteristic of, and confined to, islands held by the Dutch.

The lead in this enterprise was taken by the oldest of the English presidencies. The Government of Fort St. George established an experimental garden at Samalcotta as a centre in which to grow and from which to distribute the plants that yield "cinnamon, nutmegs and cloves," and another similar garden at Marmalon, to be used, like the garden at St. Vincent which had supplied the idea, for the naturalisation and distribution of economic plants generally. The Dutch in Ceylon, with this example at their door, now formed a garden on the lines of that at Marmalon, in Slave Island, near Colombo. But the effect of the action taken by the Government of Madras that was to be of most consequence to Eastern Asia was that produced on the Government at Fort William in Bengal: the healthy rivalry between the two presidencies could not suffer the one at which the Governor-General resided to lag behind its neighbour to the south. The Bengal Government gave favourable consideration to a proposal by the Secretary to their Military Board that a botanic garden be formed at Calcutta. This proposal was approved by the Court of Directors; the new garden was founded in 1786. From the outset, the Calcutta garden was intended to combine the objects for which the two Madras gardens had been formed. There was a hope that the effort to establish "cinnamon, nutmegs, and cloves," which had failed in Coromandel, might succeed in Bengal; there was a further hope that it might be possible to naturalise in Bengal teak and other trees, from various parts of India and Burma, whose timbers were of importance to shipbuilders, in order that the company might eventually be able to construct new and repair old vessels with material grown in the vicinity of its own dockyard on the Hughli.

The records of the two Madras gardens show that they differed in more than their original purpose. That at Samalcotta was placed in charge of Dr. William Roxburgh, whose competence as a "phytologist" is established beyond dispute by the recognition accorded his economic labours by the Royal Society of Arts, and whose eminence as a "botanist" was manifested in his great work on the "Plants of Coromandel," prepared while he was superintendent of the Samalcotta garden. The advantage to his charge and to his correspondents of a superintendent who "knew plants" and could describe and name them, was that anything raised at and distributed from Samalcotta must be exactly determined and accurately designated. The garden at Marmalon was in charge of a competent "phytologist" who, however, was not a "botanist" in the contemporary sense and as defined by the great Linnaeus. We read in an official letter to the Governor of St. Helena, dated February 15th, 1791: "I have forwarded some trees under their Indian names rather than wait for the examination of their flowers and fructification." The Dutch garden in Ceylon seems in this to have resembled the garden at Marmalon. So, during its earlier years, did the Calcutta botanic garden. But when in 1793, Lieut.-Col. Robert Kyd, its founder and first superintendent, died, the Court of Directors at home appointed Roxburgh to succeed him, ordered his transfer from the Madras establishment to that of Bengal. With the advent of Roxburgh the Calcutta garden became a botanic garden in fact as well as in name. But this change in the character of the Calcutta garden made it responsible, at least indirectly, for the disappearance of the two Coromandel gardens: that at Samalcotta was given up when Roxburgh left; that at Marmalon was abandoned some years later. When Ceylon was seized by the English, the garden established by the Dutch was abolished. But the Calcutta garden was soon to be directly responsible for the formation of two new gardens, to the east of the sea of Bengal, modelled on the one which had been made by Roxburgh for the Madras Government at Samalcotta.

When the English took possession of Ceylon they also occupied the Moluccas. The Company, notwithstanding Roxburgh's experience at Samalcotta and Kyd's experience at Calcutta, resolved to repeat, on a more extended scale, their efforts to naturalise "cinnamon, nutmegs and cloves" in India. We gain a more vivid conception of this great experiment from the correspondence of Dr. Francis Buchanan, Roxburgh's friend and successor, than from contemporary official records. Writing from beyond the Megna on May 10th, 1797, Buchanan said to Roxburgh: "I congratulate you on your success from the Spice Islands, though I am much afraid that you will have great difficulty in reconciling the nutmeg plant to the climate of Bengal. Do not you think that it might be advisable for the Company to form a plantation of nutmegs, cloves and cinnamon near Cape Comorin? For it must be obvious that our retaining possession of the Spice Islands and Ceylon at the peace will be extremely precarious."

Buchanan's fear was justified and the Government of Fort William, when it decided to seek a locality less unfavourable than Lower Bengal, chose Buchanan as the officer to look for it. But the Bengal Government did not send Buchanan to Cape Comorin; the locality they desired must be one within the Bengal presidency. Writing on January 1st, 1799, to his old friend and fellow-student, the President of the Linnean Society, Buchanan said: "Last March, April and May I was employed by the Board of Trade in examining the provinces of Chittagong and Tippera to find out the places most likely to answer for the cultivation of spices." Soon after this deputation had been arranged, but before it had begun, Roxburgh was invalided to the Cape. When the deputation ended, Buchanan was directed to act as superintendent of the Calcutta Botanic Garden until Roxburgh should return. Buchanan's letter to Dr. J. E. Smith, therefore, goes on: "My report was unfavourable; but

Chittagong is going to be tried, and I shall soon send off a number of nutmeg and cinnamon trees to be distributed among the proprietors of the southern part of the Chittagong province, especially in the island of Mascally."

By the time that Roxburgh returned, restored to health, in October, 1799, the Board of Trade knew that Buchanan's judgment as regards Chittagong had been as accurate as it had proved in respect of Bengal. The Bengal Government could not favour Buchanan's suggestion as to Cape Comorin; this would have involved the transfer of their experiment to the Presidency of Madras. But Bengal approved an alternative suggestion, made by Roxburgh, for the formation of a botanic garden at Penang. This was acted upon in 1800, as was a further suggestion by Roxburgh, carried out in 1803, that a spice plantation be established at Fort Marlborough in Sumatra. The plants with which the latter was stocked were brought direct from the Moluccas by William Roxburgh, junior, who had been appointed by the Court of Directors in 1800 to the post of Assistant to his father in the Calcutta Botanic Garden.

The enthusiasm of the Government at Calcutta presently waned. The Penang Garden was able to ripen nutmegs; the Fort Marlborough plantation proved self-supporting. But they were not under the eye of the Governor-General, and when, in 1805, Roxburgh took furlough to Europe and Buchanan went to England on duty as a member of Lord Wellesley's staff, the opportunity was taken to abolish the Penang Garden, though the plantation in Sumatra, which was free from the objection of being a "scientific" establishment, was permitted to thrive. The Calcutta Botanic Garden, of which young Roxburgh held charge during his father's absence, could not be suppressed without the sanction of the Court of Directors at home.

It was, naturally, Roxburgh's hope that his son might be nominated his successor, and the Court of Directors went so far as to agree, provided young Roxburgh should be found qualified. The reason for the appointment of Roxburgh himself in 1793 was that the Court had been advised that part of the duty of the superintendent of the Calcutta Botanic Garden should be to describe the vegetable productions of their Indian possessions and to communicate these descriptions to the learned of Europe. They could hardly accept Roxburgh's plea, submitted in 1806, that for the post he occupied "science is not necessary; that a cultivator alone is required": to have done so would have been to stultify the earlier decision. Young Roxburgh, by his father's own admission, however competent he may have been as a "phytologist," was not a "botanist" able to describe plants and communicate their descriptions to the learned of Europe. But if Roxburgh's wish could not be gratified, his son's prospects were not injured. Soon after Roxburgh's return, the superintendentship of the spice plantation in Sumatra became vacant, and in 1807 young Roxburgh was placed in charge of the garden which had been stocked by himself in 1803. This post, which he was well qualified to fill, young Roxburgh held until he relinquished the Company's service in order to become a private planter in Sumatra, a decision he reached before his father retired.

(To be concluded.)

CATTLE IN RHODESIA.

DR. ERIC NOBBS.
Late Director of Agriculture, Rhodesia.

CATTLE constitute the most valuable of the many agricultural assets of Rhodesia. The country is primarily a pastoral one, essentially suited for cattle on account of its abundant tall grass, its rolling savannah, and its climatic conditions. Rhodesia possesses some of the finest of natural pastures, a class of country none too plentiful in the world, and not to be confused with the artificial feeding grounds of England, South America, and Australasia, produced at very considerable cost. Cattle fatten in Rhodesia on the veld without lucerne, cultivated grasses, or cake, and this cheap production largely compensates for the admitted disadvantages of distance from the coast. Hitherto the numbers available have been too small to attract attention in the world's markets, but now there are two million head to draw from and the commercial possibilities of the problem command attention.

The very success which has been achieved by cattle in Rhodesia has recently brought to a climax the problem of the future development of the industry. Increase in numbers has been very rapid, as compared with other cattle countries, and has been accompanied by great improvement in quality through the use of bulls of European breeds, notably Shorthorn, Hereford, Devon, South Devon, Aberdeen Angus, Sussex, and for dairying the Friesland. The desire to experiment with minor breeds, as well as the more popular, and with crosses of European breeds, has actually led to disadvantageous complications, and to a regrettable absence of that uniformity of shape and size which is so characteristic a feature of more advanced stock countries like Canada, Australia and Argentina. In the past there have not been sufficient numbers of a fair average quality to establish a trade of even grade, and it will be some years yet before this desirable state of affairs can be fully attained; but progress that way is now being made.

It has been calculated that there is room in Southern Rhodesia for some ten million head of cattle, or five fold what is there to-day. Local consumption accounts for only about 90,000 yearly, and there is a large and steadily accumulating quantity that is uneconomical to keep and that ought to be disposed of periodically. To realise beneficially this surplus has become a very serious problem indeed, and the position

of late was so acute, owing to the glut and the lack of adequate markets, that cattle had come to be regarded as a liability in place of an asset; the chief product of the country had become a burden, the price of cattle had fallen ruinously, and the value of land had consequently diminished. In these circumstances ranching as a business was falling into disrepute, those who owned cattle were faced with great loss, and there was not only no expansion, but actually an ebb in development, as manifested by the statistics of ranchers and smaller cattle owners, and especially by the decline in importations of high-class breeding stock.

This unfortunate state of affairs had not been unforeseen; it was indeed obvious that continuous increase of cattle without a corresponding provision of outlets must have serious consequences. Some four years ago those interested in the cattle trade of the country—and that means all the leading farmers and landowners—furnished information which was collated and published by the Government as a bulletin, in which the facts of the position were set out in a manner that forbade denial, but encouraged discussion. The questions raised were widely canvassed, and in due course a Committee of inquiry was appointed. This commission, after investigation, submitted to the Government a series of recommendations which—unlike the recommendations of many such bodies—have already been acted upon as far as the most important issues are concerned. Certain complications as to existing outlets have arisen, both in respect of export of cattle through Northern Rhodesia to the Belgian Congo and to the great meat market on the Rand. In time to come it will be neither of these markets, helpful as they are at present, that will absorb the beef produced on the plains of Rhodesia; the big market, supplemented perhaps by inland consumption, must be found overseas—that is, in England or on the continent of Europe.

As a result of prolonged negotiations an arrangement has quite recently been come to between the Government of Southern Rhodesia and the Imperial Cold Storage and Supply Company, whereby modern meat works will immediately be established in Rhodesia and storage and marketing facilities provided for beef and all meat products and other perishables. For ten years the exclusive rights to this class of business are accorded to the company and ten per cent. profits guaranteed, subject to a limit of £15,000, the Government to share in profits, if any, above ten per cent., and to appoint a director on the Board to safeguard its interests. Necessary land for the business is also to be provided, where available, by the Government. The agreement is interesting in that it is a genuine and practical attempt to provide and assure, through the Government, markets for a staple product, and at the same time to obtain the benefits of the skill, energy and experience of a large proprietary commercial concern. A monopoly is granted, yet the principles of co-operation are secured, not perhaps to each individual producing, but collectively to the inhabitants of the country, who thus have a direct interest in the success of the undertaking. All concerned are united in one common aim, and the potentially conflicting sections of prime producers, manufacturers, intermediaries and distributors are brought into harmonious and economic unity.

The beneficial consequences of this happy solution of the critical position which faced the country are hard to over-estimate. Even by certain preliminary measures taken last season as an earnest of the intentions of the company, immediate relief of the congestion of prime cattle was given, and at once a stable price for such cattle was fixed at ten shillings per hundred pounds live-weight delivered on rail. The indirect benefits are even greater. At a low estimate the value of all cattle has been raised by a pound a head—a clear increase of national wealth by £2,000,000 for a stroke of the pen, while all land at once received an added value, greater still in the aggregate. These increased values are permanent and add to the total national capital for every calf dropped and every acre of land taken up. Further, the establishment of the works means an investment in Rhodesia of several hundreds of thousands of pounds in buildings, plant, and special refrigerator rolling stock, and brings into the country a number of skilled operatives and their dependants—quite a consideration in so small a community.

It is now safe and honest to recommend Rhodesia to the stock farmer, the rancher, the cattle and land company, and the investor in such enterprises, in a way not possible during the past few years, when the supply of finished cattle exceeded the capacity of the limited markets. It is not to be inferred that all difficulties are removed, or that anyone can without effort, knowledge, or even risk, embark on cattle-raising in Rhodesia; but certainly the main problem is now solved. Larger numbers of cattle and of cattle men can only help the development of the industry and benefit those already in the field.

Improvement of quality by the extirpation of the scrub, the more general and consistent use of pure-bred bulls, the culling of inferior and mongrel stock, and the production of large numbers of cattle all of one size, one shape, one age and one quality—these are still matters for the cattlemen of Rhodesia to see to. Disease is fairly well in hand, but as numbers increase so contagion becomes more easy, and there must always be need for Government control, research, inspection and supervision. Economical assistance by State and other banks is warranted where the expenditure benefits not only the borrower, but the country at large, as in the case of fencing and the purchase of superior bulls. There is scope for co-operation in production along these lines, and in many other ways. It is up to producers to unite so as to collect and forward consignments in commercial quantities instead of sample specimens; also to

steady markets by extending to the utmost the season and arranging for first supply from early districts while keeping back stock from late districts, thus regulating the flow to the works and so helping the development of the trade.

At first, as experimental consignments have demonstrated, Rhodesian beef is likely to be forwarded in hard frozen condition for export through Durban, but in time no doubt Beira, which is the nearest port on the African coast, or Walvis, the British port nearest to Europe, will be the point for loading into ships. The carcases so far sent have been well fleshed without great quantity of fat, suited rather to the continental trade than to the taste of the British public. On its merits, Rhodesian beef is certain to command its place in the world's markets.

"Re-printed from The Field."

TUBE WELLS.

Installation in the United Provinces.

DR. H. MARTIN LEAKE, M.A., SC.D., F.L.S.
Late Director of Agriculture for the United Provinces.

"THE installation of tube wells in the United Provinces is likely in time to have important results judging from the remarks on the subject made in the annual report of the Department of Agriculture. The Agricultural Engineer has completed 141 tube wells, which provide water for some 20,000 acres. It is expected that with the existing equipment an additional 50 wells will be provided annually, but if new proposals which are under examination should be approved the number will be raised to 65. After a few years' steady work, says the report, an appreciable acreage, perfectly protected, will be added to the irrigated area of the Provence ; it will, moreover, be possible to cultivate this area intensively with an assured supply of water at the time it is required. It is noteworthy that experiments are being made to provide wells at a cheaper cost than that of those hitherto in use. The expenditure on the construction of large tube wells and engines is roughly from Rs. 12,000 to Rs. 14,000, which limits their use to persons possessing capital. A small cheap and durable type of strainer tube has accordingly been invented, and a well of this type has been constructed, yielding about 15,000 gallons an hour at a cost of Rs. 2,944, including a 7 b.h.p. oil engine. It is not possible without further experience to give a final opinion as to the ultimate success of this type of well, but the experimental results are promising."

The above is culled from the *Pioneer Mail* of Allahabad. The type of well referred to is one which has been found very efficient in alluvial tracts such as the Gangetic plain where water is borne in strata composed of very fine sand and at not too great a depth. Under such conditions a special strainer is required with a mesh fine enough to hold up the sand. This strainer is strong enough to be built into the tube and it is then possible to draw on more than one water-bearing stratum at the same time. In the process of making the bore which has to be lined, the levels of the various water-bearing strata are noted and when a sufficient depth is reached a tube is built up of pipes and strainers in such a way that, when inserted in the hole, the strainers lie opposite the water-bearing strata. The casing pipe is then withdrawn leaving the sand in contact with the strainer.

Where, as in the tracts under reference, the water level is something less than 40 feet below ground level the pump can be erected in a sump and driven by an engine at ground level. In larger installations a 15-inch bore is made and the depth of the bore may be some 200-300 feet. Under these conditions a 16 h.p. engine will give a discharge up to 40,000 gallons per hour, a supply which will protect some 400 acres.

These installations not only supplement, but are actually more satisfactory than the canal supplies in that they are absolutely under the control of the landholder while the canals are intermittent. He is thus able to adopt intensive cultivation and grow thick, in place of thin, canes which in a 10-11 month growing season will give up to 40 tons per acre. This can be followed by a wheat crop which may total 40 bushels or over. The value of a tube well is most in evidence in those tracts which have no protection and which are dependent on a precarious seasonal rainfall. Cane in such cases cannot be grown and the wheat yield averages about 12 bushels and often cannot be sown. The capital cost, something under £1,000, has not to be charged up to the crop alone. The engine is not fully employed on pumping and can be used for crushing cane, extracting oil and so on.

COTTON IN ST. VINCENT.

Forecasting the Crop.

L. H. BURD, B.SC., Cotton Research Assistant for St. Vincent.

A STUDENT of the work carried out by Balls in Egypt might well imagine that the forecasting of the cotton crop, both as to time of arrival and probable size was a perfectly possible and not very difficult task. It would appear that one has only to take a careful set of plant development records from year to year to obtain all the necessary information. A record of flowering would determine the maximum number of bolls possible, and, making due allowance for shedding and other losses which in Egypt are apparently approximately constant at 40 per cent., the estimate of the forthcoming crop would be merely a matter of a simple arithmetical calculation. Since the period of boll maturation is roughly constant at eight weeks, the time of arrival can be stated definitely some two months beforehand,

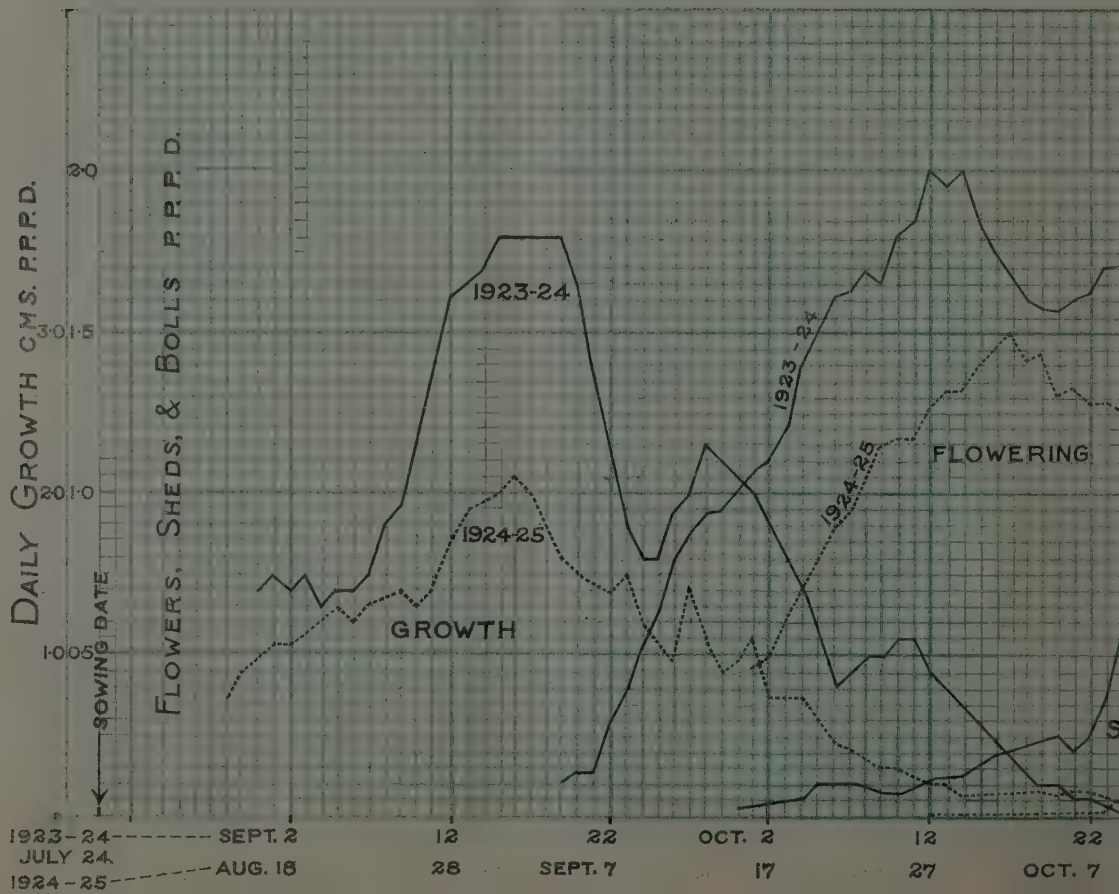
and then again, indications of the rate of flowering can be obtained from the growth some four weeks previously, which in turn enables the bolling to be forecasted, to some extent, by about three months, or even before the crop has begun to flower.

Observations made here during the last two years have shown that the question is hardly so simple in St. Vincent, owing chiefly to the impossibility of predicting the losses which will occur between flowering and bolling, which are anything but constant and may entirely upset one's earlier deductions.

The data collected during the seasons 1923-24 and 1924-25 are shown in the form of plant development curves in the figure. They were made on a group of about 100 plants of the strain BF chosen out of a plot grown for the purpose, and particular care was taken to ensure that the conditions were as alike as possible during the two years. The same material, site, and spacing were used, and except for a possible decrease in fertility in 1924-25 when the green dressing grew very badly from lack of rain, the differences in performance may safely be assumed to be due to varying weather conditions.

Growth rates were very much lower in the second of the two seasons under review, and this led us to expect, quite rightly as it happened, that the flowering rates would be lower also. This lowering of the growth rate is certainly connected with excessive rainfall, there having been 16·5 inches during July, though whether it is due to a partial saturation of the subterranean or the aerial environment or both is not at present clear. It is certainly true that high evaporation rates as recorded by the Livingstone atmometer have an accelerating effect though this is not the only factor at work.

The flowering rate being very much lower in the second season we very naturally supposed that the bolling rate and hence the crop, would be lower also, but as will be seen from the curves this expectation was not realised, and the reason is not far to seek. It lies in the rates of shedding which were very high in 1923-24 and almost insignificant in 1924-25, so much so that this lack of shedding has been enough to compensate for the small number of flowers produced, the plants retaining almost all their bolls. Thus it would seem that flowering records alone cannot be relied upon in the prediction of the bolling

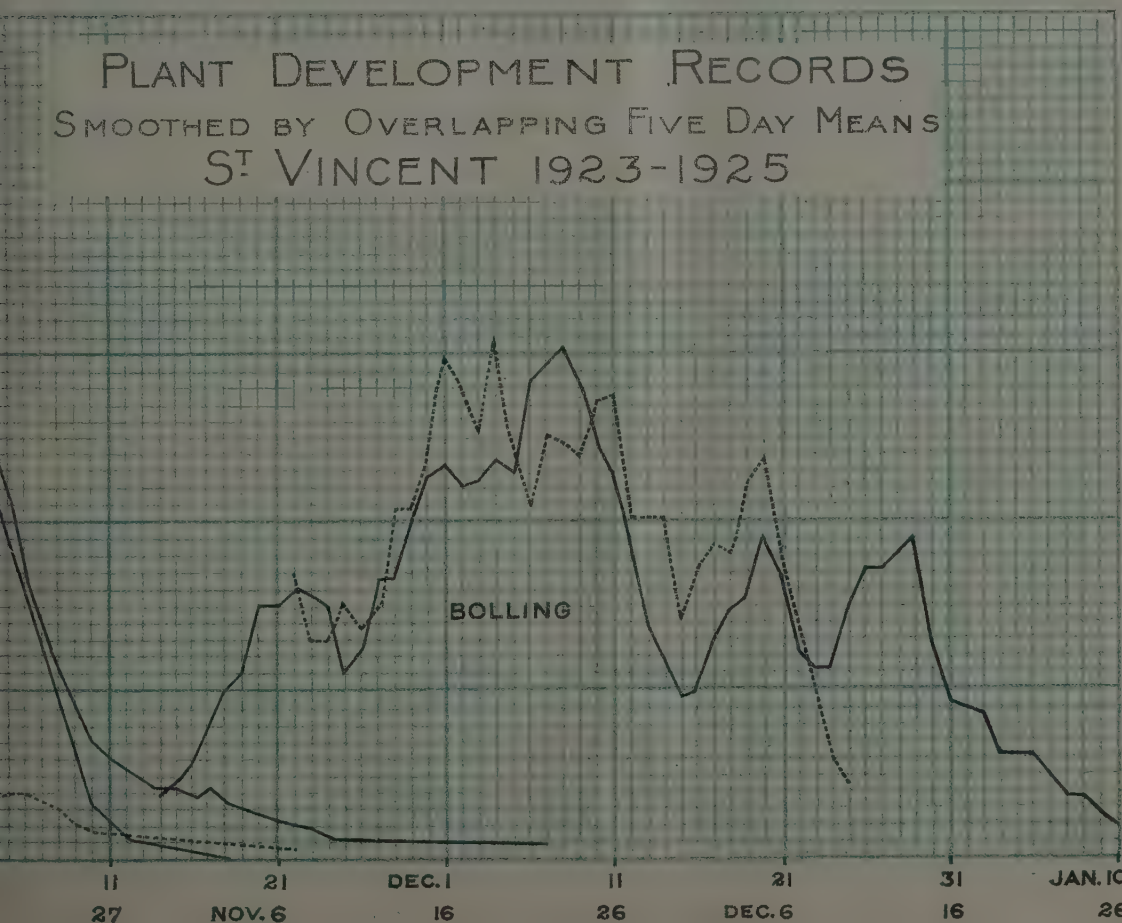


curve. The shedding which prevents the prediction usually follows torrential rain, but a mere record of rainfall is of little value in analysing the shedding causes and in any case the time which elapses between cause and effect is probably not more than a week or ten days at the outside which is too short to be of any value in forecasting. Another interesting result of the lack of shedding in 1924-25 was the remarkable accuracy of the fit between the flowering and bolling curves, the daily fluctuations of flowering and bolling curves, the daily fluctuations of flowering being reproduced 53 days later with unusual fidelity.

In addition to shedding the incidence of insect and fungoid pests may seriously destroy the possible prediction of bolling. The principal of these destructive agents in St. Vincent are Soft Rot (*Phytophthora spp.*) Stainers (*Dysdercus spp.*) and Pink boll worm (*Gelechia gossgpiella*). The first of these is very variable in its incidence and its spread se ms largely to be related with the humidity of the atmosphere during November and December. Stainers appear to be capable of control. They were almost non existent in the second season, and it would seem that by the careful continuation of preventative measures they might be permanently kept down to a minimum. The pink boll worm has only been with us for two seasons but we have reason to believe that it too can be kept within bounds.

Summing up then we may say that in St. Vincent and probably in all other places where water is not under control, the bolling rate or size of crop can never be forecasted accurately from the flowering records because of the variable losses by shedding, soft rot, and probably other diseases which cannot be foretold. All we can do with certainty is to state its time of arrival and from the total number of flowers produced deduce a possible maximum. In regard, however, to forecasting in general another point deserves mention.

The examination of bolls from dated flowers indicates that there is a considerable variation in the mean maximum lint length from day to day. Depressions in the lint length are associated with excessive rainfall around 19 days after flowering and thus they can be forecasted by approximately three weeks, and such knowledge might possibly be utilised by isolating the cotton picked during a depreciated period and thus enhancing the chances of uniformity in the product.



THE TROPICAL WORLD.

China.

The only country which produces tea oil in large quantities is China, though Japan has a small production of the same kind of oil, and French Indo-China makes an oil from the *Camellia drupifera*, which is used by the natives as a medicine. According to *Finance and Commerce* (Shanghai) the largest producing district in China is in eastern Kwangsi and southern Hunan. The principal collecting and exporting centre in the country is Wuchow, near the Kwangsi-Kwantung boundary, which annually accounts for more than half the total exports from China. Hankow is the next largest shipping port, the oil being collected from Hunan, Hupeh, and especially from Szechwan. Kiangsi Province is a large producer of tea oil, but the exports are small, as most of the output is consumed in the province. Canton, Foochow and Changsha all make fairly important shipments, and small quantities are exported from Shanghai, Ningpo, Wuchow, Amoy, Swatow, Kowloon and Nanning. Santuao had a share in the export trade until 1919, when shipments stopped altogether. Of the tea oil exported from China, between 75 and 80 per cent. annually used to go to Hongkong, but of recent years Japan has taken almost as much as that port, Great Britain holding third place in the export trade. Of the 1921 shipments Hongkong took 7,483 piculs and Japan 6,539 piculs. The following year Hongkong's share of the exports totalled 7,598 piculs and Japan 6;373 piculs, while England took 1,343 piculs. Exports of tea oil from China in 1923 amounted to 12,950 piculs, valued at Hk. Tls. 154,600.—(*Chamber of Commerce Journal.*)

Philippines.

Preliminary figures relating to the foreign trade of the Philippine Islands for the first nine months of 1924 reveal a decided advance over the corresponding period of the previous year. The export trade was valued at 205,631,000 pesos and imports were received to the amount of 157,521,000 pesos, an increase of 53,000,000 pesos in the total value of foreign trade. Of the imports, cotton cloth at 26,654,000 pesos was the most important item, followed by iron and steel manufactures, 18,847,000 pesos; cotton and manufactures, except cloth, 10,421,000 pesos; meat and dairy products, 7,164,000 pesos; wheat flour 5,869,000 pesos; automobiles, tyres and parts, 4,774,000 pesos; paper and manufactures, 4,571,000 pesos and leather and its manufactures 1,755,000 pesos. Among the products exported from the islands, sugar and manila hemp were the most important, the former totalling in value 75,056,000 pesos, and the latter 40,915,000 pesos. Coconut oil and copra also figure prominently at 23,962,000 pesos and 21,958,000 pesos, respectively. Cigars and cigarettes, leaf tobacco and copra cake were shipped in large quantities—(*Chamber of Commerce Journal*).

Gambia.

Gambia is the most northerly of the British possessions in West Africa. It consists of a narrow strip of land bordering the River Gambia for a distance of about 4 miles from each bank and extending eastwards from the coast for over 250 miles. The total area of the country is approximately 4,000 square miles. The population at the 1921 census, exclusive of the migratory farmers, was estimated at about 210,000.

Ground-nuts is the only crop grown in the Gambia for export. The Department of Agriculture, therefore, are concentrating their attention on the improvement of the ground-nut crop and the crops grown for native food. Ground-nut seed is supplied to the native growers every season by the Government, who usually purchase it from the exporters. In this way an annual change of seed in each district can be ensured. Every few years the Government imports seed nuts from Senegal in order to maintain the quality. With regard to yield, there are no definite statistics available but it has been estimated that the average yield for the whole country is 44 bushels per acre.

Mr. M. T. Dawe, F.L.S., Commissioner of Lands and Forests in Sierra Leone, who was appointed by the Colonial Office to report on the agricultural needs of the Colony, discusses the prospects of cultivating other crops than the ground-nut for export. First among these he places tobacco, which he considers could be grown successfully on a commercial scale. Before this could be done, however, experiments would have to be carried out by a competent agriculturist, and in his recommendations for the staff of an Agricultural Department be included a tobacco expert. Other crops suggested included maize, rice, and citrus fruits. Sisal hemp would probably grow well, but its cultivation in the Gambia is not recommended, as it is not suited to native farmers, since it requires large areas under cultivation and the installation of costly machinery.—(*Bulletin of the Imperial Institute* Vol. XXII, No. 4.)

Seychelles.

The most important of the Colony's industries is the cultivation of coconuts. From a recent *Colonial Report* we learn that the total export of copra during 1923 amounted to 3,475 tons as compared with 2,986 tons in 1922. Only about a quarter of a million coconuts were exported during the year under review as compared with half a million the previous year. Coconuts sold locally during the year at a price of about Rs. 40 to Rs. 48 per thousand, while copra averaged about Rs. 400 per ton.

The low price of vanilla, together with the root disease to which it has been subject in this Colony, has caused what was at one time the most valuable export from Seychelles to become the least important. Very little vanilla was exported during 1923, but it is anticipated, that the higher

prices commanded by this commodity at the present time will stimulate its production in 1924. It is also satisfactory to note that the vines now planted are withstanding the root disease.

The depressed state of the rubber industry is reflected in the Annual Report of the Department of Agriculture, in which it is reported that Para rubber trees are being cut down all over the Colony and used as firewood in essential oil distilleries except on one estate at Praslin where rubber is still being produced at a cost of 30 cents a lb. f.o.b. There is always a demand for Para rubber and the price of that article may rise at any time. It is therefore unwise on the part of planters to get rid of their plantations, although in some cases the mistake is not very important for many trees had been rendered worthless by murderous methods of tapping and in a few localities Para rubber has become established as a jungle plant and will never be completely destroyed. On the other hand wood is becoming so scarce in this Colony that the demand for firewood largely exceeds the supply and the consequence is that any tree which is not actually productive is cut down for the requirements of the distilleries. This shortage of firewood is inducing planters to devote some part of their estates to tree planting which from all other points of view is so very greatly needed in the Colony which has been so much "deforested" in the past.

Straits Settlements.

During the year 1923 restriction of output combined with an increase in demand maintained the price of rubber at a figure providing a margin of profit on practically all estates; at the same time sufficient money was available to provide for proper attention to works of maintenance, such as drainage, weeding and sanitation. Two rubber factories continue in operation in Singapore. Experimental work on the vulcanisation of latex is being continued on an estate in Malacca and some of the articles and materials manufactured by this process appear to be very promising.

The necessity for preventing loss of valuable surface soil from clean cleared slopes, subject in this country to heavy rains, is now widely recognised by planters. Systems of catchment pits, terracing, and the use of cover crops or plants such as citronella and lemon grass are in common vogue on estates.

The price of copra rose from $10,30 a pikul (133⅓ lb.) at the beginning of the year to $13.10 in April. It fell to $9.75 in July and rose again to $12.14 in December. The average price for the year was $11.30. The price of nuts varied from 4 cents to 6 cents each at different places and times. These prices provided coconut cultivators with a considerable profit during the year. The outlook for this crop is satisfactory.

The favourable condition of the coconut and copra market during the last few years has been a satisfactory feature of a difficult period. It is, therefore, the more regrettable that the rush for rubber and the large profits induced owners, even as recently as 1916 and 1917, to destroy so many of their palms. The fine growth and yield of these trees on many of the coastal lands of this Peninsula, the ease with which they can be cultivated, and the steady market for their produce render this industry a particularly suitable one for Malay small holders. It is greatly hoped that co-operative methods of marketing can be introduced in the near future for the benefit of proprietors of small holdings and that the considerable profits which they at present enjoy, may be increased thereby.

One large mill in Singapore is carrying on the manufacture of coconut oil and copra cake. It is understood that it is difficult to dispose of the oil, but that the cake finds a ready sale in Australia. The manufacture of desiccated coconut at Butterworth appears to be thriving; the plant in the one factory in operation has been increased. The price of desiccated coconut products is fair. —(*Annual Colonial Report No.* 1235.)

Palestine.

In a Bulletin issued by the Agricultural Experiment Station of the Institute of Agricultural and Natural History, a Zionist organization, on the agricultural aspects of a sugar industry in Palestine, it is stated that sugar-cane is already grown in the country, and the canes are sold in the markets for chewing. Only a small area, however, is devoted to its cultivation. The present annual importation of sugar into Palestine amounts to about 8,000 tons, but it is considered that the consumption is likely to increase rapidly in the future. Unfortunately, the preliminary experiments conducted were subject to defective irrigation, and the value of the results was, therefore, diminished. From 45 to 100 tons of cane per hectare were obtained, the sugar content ranging from 9 to 18 per cent. Further experiments on a larger and more satisfactory scale are necessary to admit of definite conclusions being drawn, but it is considered that high yields of cane could be obtained under proper cultivation. Difficulties would, of course, be encountered with regard to labour, wages in Palestine being higher than in Egypt and other cane-producing countries, and the fact that the industry requires seasonal workers is regarded as an unfavourable feature. But, on the other hand, the value of the land and the cost of irrigation would be much less than in Egypt. It is suggested that the industry might be established on a system of small holdings, thus eliminating expensive hired labour; and, further, it is proposed to explore the possibility of extending the harvesting period, and consequently the manufacturing period, together with the possibility of combined cane and beet sugar production in two different seasons.—(*Chamber of Commerce Journal.*)

Tonga Islands.

The Kingdom of Tonga embraces the groups of islands of Tongatabu, Haabai and Vavau, together with the outlying islands of Niuafoou, Niuatobutabu and Tafahi, lying between latitudes 16 and 22 degrees south, in the western Pacific. Queen Salote is the present ruler, assisted by a British Agent and Consul appointed to advise the Queen and Government of Tonga, and to supervise the administration of the Kingdom.

The trade of Tonga depends almost entirely upon the copra industry, and variations in the annual volume of trade are very largely a reflection of the price of that commodity in the world's markets. In 1923-24 copra exports amounted to 14,339 tons, valued at £257,009, and constituted 96·03 per cent. of the total value of exports. Attempts to re-establish the banana trade with New Zealand have so far failed. This is unfortunate in view of the fact that the island, are within the hurricane belt and coconut trees are liable to suffer for a longer period than bananas when gales damage the plantations.

The year 1923 was a prosperous one in the history of the islands, owing to the firmness of the copra markets and the absence of hurricanes. The direct steamship service of the Clan Line between the United Kingdom and Fiji will provide the island with a new two-monthly service. This will benefit Tonga considerably.

India.

The *Bulletin de l' Association des Planteurs* has some interesting information concerning the tea industry in India. The first trials of tea were made nearly a century ago, when the British Government sent to China to study the best methods for its cultivation. In 1860 India only exported 2½ million lb. of tea ; sixty-two years later 360 millions were exported. The chief outlets for her supply are England and Ireland (268 millions in 1922), Canada (11 millions), the United States of America (4,500,000 lb.), and Australia and New Zealand about the same in round numbers. The English companies operating in India spared no efforts to get the best results from their plantations. With a capital of £30,000,000 they have achieved the wonderful result of bringing the average yield per acre up to 300 and 600 lb., within the last thirty years. In Assam, where the most prosperous plantations are, a yield of 800 lb. per acre is often obtained.

Every important tea plantation in India has its factory. The products are sent direct either to London, where they are sold at auction or to Calcutta. The consignments to Calcutta are those destined for countries other than Britain. Each shipment is taxed twice, the total amount levied being 1·63 pence per lb. The funds are utilised by a semi-official organisation in financing propaganda on a large scale in favour of Indian tea.

Ceylon.

The Ceylon Forest Department have been engaged in preparing a working plan report for the conversion of up-country forests for the supply of chests for the tea and rubber industries. According to the Annual General Report on the Colony, recently to hand from Colombo, the proposal is to convert about 14,000 acres of indigenous jungle and patana into coniferous forests, on account of which some 2½ million rupees now leave the country every year. The proposed period of rotation is eighty years, but this may be reduced when full data are available. Indigenous jungle will be utilized for firewood and local timber requirements, and the existing licence system will be superseded. In this connection the introduction of arboreta and central nurseries is receiving close attention, and seed of numerous coniferous and other species has already been imported.—(*Chamber of Commerce Journal.*)

Jamaica.

Some interesting details concerning the manufactures of Jamaica appear in the latest Government report on the Colony. The principal products manufactured are sugar, rum, copra, sisal, banana figs, orange oil, cigars and cigarettes, and leather. The sugar industry has of late been meeting with difficult conditions due to over-capitalization of most of the estates about 1919, the short period of enhanced prices for this product, and the unstable market which has since prevailed. There was a considerable decrease in the annual output, there having been only 39,049 tons in 1923, as against 54,316 tons in 1922. The average in canes under cultivation during the year 1922 was 44,004 as against 48,184 last year, and the decrease in the output of sugar is accounted for by the severe drought which was experienced during 1923. The rum industry, which is so closely allied to the sugar industry, has been necessarily affected by prevailing conditions. The heavy duty imposed by the United Kingdom almost paralysed the trade with that country. The output last year was 7,500 puncheons, as compared with 13,073 puncheons in 1922. The copra industry still shows signs of further development, but there has been a shrinkage in the marketing of the unmanufactured product, viz.: the coconut. In 1923, 5,207,094 lb. of copra was exported, as compared with 2,563,550 lb. in 1922. Several sisal factories are now in full swing, and an excellent quality is produced, for which high prices have been obtained. There has been no appreciable increase in the export of banana figs, although a fair quantity is still shipped. The output of orange oil has improved and is apparently gaining a foothold in the European and American markets, despite competition with oils from Sicily. Cigars still hold a good place in the exports of the Colony and in demand for home consumption, but

cigarettes manufactured in Jamaica have a formidable rival in the foreign article. The tanneries at various centres of the island continue to turn out a fair amount of sole and harness leather, some of which is exported. Jamaica also possesses a match industry which, however, has to meet powerful competition from the imported article. Among the minor industries of the Colony may be mentioned the manufacture of jippa jappa hats, which attracted great attention at the British Empire Exhibition, and baskets which are largely made for local use.—(*Chamber of Commerce Journal.*)

The Union of South Africa and Rhodesia.

The Official Report of the Textile Conference held at the British Empire Exhibition contained an article by Mr. W. H. Himbury of the British Cotton Growing Association in which some interesting information concerning cotton growing in this country is given.

Since 1910 cotton has been exported from the Union of South Africa, but the quantity up to 1916 was not very large. In 1919 it was about 2,000 bales, and for the last season about 6,000 bales. Cotton is grown on plantations and on land owned by farmers, and not as a native industry. The chief centres of production are the Rustenburg and Nelspruit districts of the Transvaal, Natal, and Zululand, a large proportion of which is situated on the Pongola Poort and Candover Estates. The results which have been obtained give some promise that the cotton industry is likely to become a permanent one.

Besides those districts in the Transvaal and Natal including Swaziland and Zululand, which are already growing cotton, there are in addition large tracts of land which have a soil suitable for cotton culture. These latter districts are, however, at present uncultivated, and their development must largely depend on the question of the labour supply. Although labour is scarce in many districts, and the mines absorb a large proportion of the available supply, there is stated to be in South Africa as a whole, a certain quantity of labour which is lying idle or dormant, but which might be put to agricultural work. In order to guard against the introduction of insect pests stringent regulations have been enacted against the importation of cotton seed and unginned cotton into the Union from any other country except under Government supervision. For the successful development of cotton growing in South Africa and in all cotton growing countries it is of the utmost importance to maintain a pure seed supply.

One of the most suitable varieties which has been produced in the Union is the "Bancroft" type, and if this seed can be obtained and kept pure then it might be continued. That most excellent cotton can be grown has been proved; that there are facilities both in suitable soil and labour for growing a large crop is also beyond doubt, and as the Department of Agriculture is now tackling the problem seriously, progress should be well maintained.

The newly established Colony of Southern Rhodesia is a promising area as a supplementary source of supply. It has been known for many years that cotton could be grown, and no doubt the present high prices will help to induce the farmers to consider the question of cotton cultivation on an extensive scale.

In North-Eastern Rhodesia cotton has also been grown for some years, but the crops for the past three or four years have not been very large. This is partly due to tobacco proving more remunerative and cheap transport facilities being non-existent. Geographically, North-eastern Rhodesia is a part of Nyasaland. Transport is the problem, and it is doubtful if there can be any large development until that territory is connected by railway with either the Zambezi or Blantyre.

(*We understand that a few copies of this valuable report can be obtained from the Textile Institute, 16, St. Mary's Parsonage, Manchester, at a price of 5/- post free.*)

Uganda.

Details appearing in the latest Government report on Uganda show that during last year the total value of domestic produce exported from the Protectorate amounted to £2,393,678, as compared with £1,215,793 for 1922. The value of ginned cotton shipped amounted to no less than £2,026,820 or more than 84 per cent. of the entire outward trade. In all four provinces there was a satisfactory increase in the acreage sown, and the total area under cotton was estimated at 418,600 acres, representing an increase of approximately 71,500 acres on the area planted in 1922. The principal cotton area is the Eastern Province, where it is estimated that 298,000 acres are under cultivation. Considerable progress has been made in the use of ploughs by natives; new ploughing schools have been established in Budama, Bugwere and Bugishu districts. Coffee is another important Uganda crop. Last year was very satisfactory for the majority of European planters, and exports from some 170 plantations totalled 40,932 cwt., valued at £108,496. Compared with 1922, the latter figure shows an increase of £9,269. The natives have shown satisfactory progress in coffee-growing. Tapping for rubber was resumed on many estates during 1923, and the exports amounted to 398,600 lb. valued at £9,926, as compared with 124,867 lb. for the previous year. Rapid strides have been made in establishing the cultivation of rice in the Eastern Province, and there has been a considerable increase in the area under chillies, shipments of the latter totalling 18,233 cwt., valued at £58,660, representing an increase of 6,298 cwt. over the production in 1922.—(*Chamber of Commerce Journal.*)

WEST INDIAN HURRICANES.

In Supplement No. 24 of the *Monthly Weather Review* of the United States Department of Agriculture the results have been published of a comprehensive study of the tropical storms of the North Atlantic Ocean. This research was prompted by an idea, long held by Dr. C. L. Mitchell, that West Indian hurricanes never originate over the eastern two-thirds, approximately, of the Caribbean Sea. To test this supposition Dr. Mitchell has listed and replotted all storms since 1886, which are mentioned in various publications as developing in the questioned area. In every instance he has found the first evidence of storm development, although rather obscure in some cases, either over the western third of the Caribbean Sea (west of longitude 78°W.) or to the east of the eastern limits of this sea.

The storm charts for the hurricane months, June to November, show strikingly the advance and decline of the hurricane season. In June and July storms rarely reach hurricane strength and their paths are comparatively short. In the former month the storms originate either over the Caribbean Sea, west of longitude 80°W. or over the Gulf of Mexico. In the latter the majority enter the Caribbean from the east.

The height of the hurricane season is reached in August and the first part of September. There is then, not only a marked increase in the number of tropical disturbances, but also in the percentage of the number which develop hurricane strength. Over 54 per cent. of the true hurricanes of the past thirty-seven years developed within this period of six weeks. In August, 1893, there were four hurricanes in progress at the same time and in September, 1900, there were three. The two hurricanes which of recent years have devastated the island of Montserrat both occurred in August, one in 1899 and the other in 1924.

The majority of the August storms originate in the region of the Cape Verde Islands. A few develop over the Gulf of Mexico, but none over the Caribbean Sea. Before the middle of September the number developing over the Cape Verde region decreases, a few originate over the western third of the Caribbean Sea, and more over the Gulf. In the latter half of September the number of storms developing over the Caribbean Sea continues to increase, but there is, on the whole, a considerable decrease both in the total number, and in those which reach hurricane strength. This period of comparative calm is, however, followed by a further series of severe storms, there being twice as many storms in the first fortnight of October as in the latter half of September. The decline in the hurricane season then sets in rapidly, few tropical storms developing after the middle of October or during November.

The conditions which are necessary for the development of cyclones are mentioned by Dr. Mitchell. These disturbances do not originate within several degrees of the equator and for this reason Trinidad is not subject to hurricanes. Other conditions being equal, the farther a region is from the equator the more likely a cyclonic storm will originate there. It is generally agreed by meteorologists that high temperature and high humidity are favourable, if not essential, to the development and maintenance of a tropical cyclone. Both of these requirements are met with in the doldrums, a region over the ocean between the north-east trade winds of the northern hemisphere and the south-east trade winds of the southern hemisphere.

As has been stated above, most of the August storms develop in the region of the Cape Verde Islands. In June the doldrums in this region are about 8° to 9° north latitude. This is too near the equator for the development of cyclones. In August and September the doldrums in this longitude are 12° to 13° north of the equator, sufficiently distant from it for the development of storms. As the highest humidity in this locality occurs in August and the first part of September, all the conditions are suitable for storms to originate there. The doldrums do not occur at all in the eastern two-thirds of the Caribbean Sea. For this reason tropical cyclones never develop over the Caribbean, east of longitude 78° W.

The paths followed by storms during the hurricane months are of great interest. Those tropical storms which originate north of the equator tend to move to the west or north-west at the first opportunity, and later curve back to the north-east. The great majority of West Indian hurricanes during the first few months of the storm season curve back in regions further to the west than those occurring later. This is due solely to the infrequency of troughs of low pressure east of the Atlantic Coast States of the south-eastern United States during these months, for Dr. Mitchell has made it evident that any tropical storm will recurve into an area of relatively low pressure which may exist when the storm arrives in the same region. An area of high pressure extends, during the early part of the hurricane season, from the Azores, west-south-west to the coast of the United States, which seldom breaks down during this period. No storm will break through this and recurve until it reaches a region of relatively low pressure to the north. As autumn approaches, the Atlantic high pressure area breaks down more often, giving a tropical storm more opportunities of encountering a low pressure area. Those storms developing east of the Lesser Antilles after the middle of September have a greater chance of recurving east of the longitude of Bermuda than those developing before this time, because of the increase in the number of areas of low pressure into which tropical storms may move.

P. E. T.

The Editor will be pleased to send a gratuitous specimen copy of *Tropical Agriculture* to any one interested in tropical development.

THE COLLEGE SUGAR FACTORY.

Official opening ceremony.

ON the afternoon of Saturday, February 28th, 1925, His Excellency Sir H. A. Byatt, K.C.M.G., Governor, of Trinidad and Tobago, officially opened the Experimental and Instructional Sugar Factory of the Imperial College of Tropical Agriculture, the first of its kind to be erected in the Empire. In view of the fact that nearly all of the factories in the island had already begun crushing, it was decided to have the factory in operation in order that those attending the ceremony might have the opportunity of seeing the factory in full working order. In spite of the heavy rain, and the fact that many interested in sugar production were unable to leave their factories, a large number of the members of the Sugar Manufacturers Association, the Agricultural Society and the Chamber of Commerce, and other interested gentlemen were present.

His Excellency, accompanied by the Colonial Secretary, the Hon. T. A. V. Best, C.M.G., C.B.E., and Captain Traill, M.C., A.D.C., was met by the Hon. R. G. Bushe, C.M.G., Chairman of the Executive Committee of the College, and the Principal, and introduced to the other members of the Executive Committee, and College Staff. The mill was stopped for a short period and the following speeches were delivered from the mill platform.

The Principal, DR. H. MARTIN LEAKE.

In the few minutes during which the factory is closed for this ceremony it would be impossible for me to give in detail an account of its origin. We have, therefore, prepared a record which is available for all who have attended to-day. It is true we might have asked your Excellency to attend to crush the first cane to pass through the mill but this is the busy season for the planter and it seemed preferable to compensate them for their journey to-day by a view of the factory in full working order. We have, therefore, run the factory since Tuesday last and it is now possible to see all parts in operation.

It is unfortunate that Sir Francis Watts has been unable to attend at this ceremony since the idea of such a factory as this was in large measure conceived and realised in practice by him.

MR. E. A. ROBINSON, Member of the Governing Body and Executive Committee of the College.

The need for chemical control in the factory is a matter which is becoming more and more realised as time progresses and the position occupied by the Chemist is yearly assuming greater importance. Such control takes the form of checking the amount of sugar produced and comparing it with the amount of sucrose present in the canes supplied to the mill. It also takes the form of checking the sugar content at each stage of the process of manufacture so as to determine the stage at which any loss occurs. This, however, is not all that is required; it is necessary to determine the cause of the loss and for this something more than mere determination of the loss is required. This is the function of the sugar technologist who must have a sufficiently wide knowledge and experience of factory work to identify causes.

The value of such a man is undoubted and so far we manufacturers have had to look to foreign countries for such men as the means of securing such training have not been available within the Empire. We now have in the College and the Factory the requisites for the efficient training of such men and the benefit the Empire should derive from these facilities should be inestimable.

Sugar production, again, is only a relatively efficient process; there are still losses of some magnitude and there are probably still considerable openings for simplification of the processes with reduced costs of production. This indicates a profitable field for research for which also facilities are now available within the Empire. I, as a representative of the planting community, welcome the step forward which is marked by the ceremony of this afternoon.

PROFESSOR FARMER, Member of the Governing Body of the College.

It is my privilege, as a member of the Governing Body of the College in London to express the great interest we have all felt in this extension of the College activities in the direction of Sugar Technology. It is an extension we have desired to bring about ever since the College itself was founded. I wish therefore especially to associate myself with previous speakers in gratefully acknowledging the help and donations of valuable equipment which has now made this factory a possibility, and through it of enlarging the sphere of usefulness of the College to an important branch of tropical industry.

His Excellency the Governor, SIR H. A. BYATT, K.C.M.G.

It gives me great pleasure to be here this afternoon because the opening of this model sugar factory marks a most important step forward in the scientific development of the agricultural resources of our great Empire.

Notwithstanding the fact that the output of sugar from the British Empire now reaches four and a half million tons annually no provision has hitherto been made at any University or College in the Empire for giving men a training in the chemistry and technology of the processes involved in its manufacture. The principles underlying the process can be, and are, taught in our own Universities, but those who sought openings as sugar technologists have had then to go to some such institution as the Sugar School at Baton Rouge, Louisiana, in order that they might gain practical acquaintance with

large scale operations in the factory itself. Mr. Robinson has from the producers point of view found the same dependence on a foreign country for factory employees, and even for estate owners themselves there has hitherto been no opening for training within the Empire. The opening of the model sugar factory at the Imperial College of Tropical Agriculture therefore marks an important advance inasmuch as it removes the reproach that young men of the Empire have been compelled to look to other countries for facilities in obtaining the training necessary to enable them to assist in developing one of our most important tropical crops.

That the importance of this project has appealed to the sugar industry at home, as the original scheme of the College appealed to the planting community of this island, is evident from the fact that nearly all the machinery in this factory, amounting to no less than £20,000 in value has been supplied as a gift by firms belonging to the British Sugar Machinery Manufacturer's Association, and the warm thanks of the College are due to those firms for their generosity, which has rendered the equipment of the factory possible.

The original conception of the scheme is due to Sir Francis Watts, the first Principal of the College, and it is particularly unfortunate that absence on Government business in Dominica makes it impossible for him to be present to see the formal realisation of his foresight and vision and the material results of his energy and enthusiasm.

It is desired now to make the College independent as a centre for instruction in all that pertains to sugar production, and for this purpose the next requisite is the acquisition of an estate, which, while providing the cane required for instructional purposes in the factory, will also serve as a means whereby a thorough training can be given in practical estate management on the most modern economic principles.

The work of the College is of Imperial importance, since the full utilisation of the products of the tropical dependencies of the Empire is vital to its economic welfare. A good beginning has now been made in Trinidad, but it is hoped that it will be widely recognised that the College is not primarily a Trinidadian or even a West Indian institution, but that its appeal extends to all countries of the Empire. That the value of its potentialities is recognised at home is shown by that fact that a Committee appointed by the Colonial Office is recommending that men selected for appointment to the agricultural staff of any colony should receive a course of training at this College. It is hoped that other Colonial Governments, and indeed all those interested in Imperial development, will contribute to the fund that is being raised for the completion and equipment of the new buildings and laboratories, so that the College may not fail through inadequate resources to reach the high ideals which it has set itself to achieve.

The machinery was then restarted. His Excellency was conducted around the factory by Professor Boyd, Head of the Department of Sugar Technology, and the visitors moved freely around the factory examining the machinery in detail. Full information concerning the history of the Factory, the College Course in Sugar Technology, the Machinery, and the first list of Presentations is published in the supplement which accompanies this issue of the Journal.

In addition to His Excellency the Governor, the Staff and Students of the College, the following gentlemen were among those who were present at the ceremony :

Mr. Frank Agostini, Dr. H. M. Alston, Messrs. L. G. Alston, Wilfred Alston, J. W. Arbuckle, J. C. Augustus, Hon. T. A. V. Best, C.M.G., *Col. Secretary*, Messrs. E. R. Berkeley, G. P. Bird, Jas. Black, W. W. Bonyun, J. E. Boos, Capt. Thomas Boyd, Messrs. H. W. Brathwaite, A. Bruce, Maj. F. Burnett, Hon. R. G. Bushe, C.M.G., *Chairman of the Executive Committee of the College*, Messrs. R. Bynoe, Alex R. Bynoe, M. F. Camacho *Consul for Portugal*, C. Carmona, Capt. E. T. Carr, Hon. E. Radcliffe Clarke Mr. C. Cleaver, Col. J. H. Collens, V.D., Messrs. M. B. Collymore, W. T. Cunningham, Capt. J. W. Day, Mr. F. De Boehmler, Hon. Carl de Verteuil, C.M.G., Col. Sir A. R. Dick, K.B.E., C.B., C.V.O., Messrs. H. A. De Freitas, Wm. Dickson, W. Douglass, C. E. Drayton, E. Emlyn, Prof. J. B. Farmer, M.A., D.SC., LL.D., F.R.S., *Governor of the College*, Messrs. E. Farrell, J. Forbes, Hon. W. G. Freeman, B.SC., F.L.S., *Director of Agriculture and Governor of the College*, Messrs. E. Gaspard, J. Gonsalez, T. Geddes Grant, J. Grant, Geo. Grell, A. T. Greig, Arthur Hamlyn, Alick Hamlyn, A. J. Hearn, Alex Henderson, J. R. Hing King, A. L. Hope, Geo. Houlder, L. J. Kilby, A. R. Knaggs, J. Knox, Rev. C. D. Lalla, A. Laurie, F. Le Blanc, S. Liddelow, D. Mahabir, J. W. Martin, Oliver McLean, J. J. McLeod, Hon. A. H. McShine, Messrs. T. Gordon Miller, N. W. Miller, A. M. Mills, A. Morton, Rev. Harvey Morton, Messrs. W. A. Murray, L. E. Murray, Joseph F. Nelson, C. Newbold, J. O'Laughlin, Col. Pemberton, Messrs. T. H. Phipps, H. Piper, T. I. Potter, Stephen Rees, A. L. Rhodes, E. A. Robinson, *Governor of the College*, Major Randolph Rust, V.D., Messrs. J. Salvatori, *Consul for Italy*, C. Scandella, F. E. Scott, O.B.E., T. H. Scott, W. Scott, Jos. Seheult, C. Singuineau, G. Skinner, M. Hamel-Smith, H. L. Smith, A. A. Sobrian, A. Solomon, Hon. A. V. Stollmeyer, Messrs. G. Swan, G. D. Sworder, J. H. Taylor, D. Terrami, A. R. Torrance, J. B. Todd, Capt. C. J. Traill, M.C., A.D.C., Messrs. L. V. Tuck, H. J. Vieira, Hon. H. B. Walcott, C.M.G., *Governor of the College*, Messrs. A. Waterman, R. Williams, H. Wright, A. R. Yuille.

Since the official opening ceremony the College Sugar Factory has been crushing continuously, except for the usual intervals necessary for adjusting the machinery. Some 30 tons of sugar have already been manufactured and the machinery is giving excellent service. The students who are specialising in sugar technology are taking charge of the factory operations in shifts under the supervision of Professor Boyd and his technical assistants.

BOOK REVIEWS.

THE RESOURCES OF THE EMPIRE SERIES. Vol. I, Part I, *Crops and Fruits*, by J. R. Ainsworth—Davis, pp. 144. Vol. I, Part II, *Meat, Fish and Dairy Produce*, by J. R. Ainsworth—Davis, pp. 104. Vol. II, *Timber and Timber Products, including Paper Making Materials*, by S. J. Duly, pp. 228. Vol. III, *Textile Fibres and Yarns*, by J. S. M. Ward, pp. 192. Vol. IV, *Fuel*, edited by G. W. Andrew, pp. 208. Vol. V, *Rubber, Tea, Cacao and Tobacco, with special sections on Coffee and Spices*, by W. A. MacLaren, pp. 334. Vol. VI, *Leather, Hides, Skins and Tanning Materials*, by E. C. Snow, pp. 368. Vol. VIII, *Chemicals*, by A. W. Ashe and H. G. T. Boorman, pp. 207. Vol. VIII, Part I, *Ferrous Metals*, by M. S. Birkett, pp. 165. Vol. VIII, Part II, *Non-Ferrous Metals, and Other Minerals*, edited by N. M. Penzer, pp. 264. Vol. IX, *Oils, Fats, Waxes and Resins*, by E. R. Bolton and R. G. Pelly. Vol. X, *Communications*, by W. T. Stephenson. (London, Ernest Benn, Ltd., 1924, price 21*s*. per book, or £7 7*s*. the set of twelve volumes.)

This series of twelve books, according to its sub-title, comprises "a business man's survey of the Empire's resources prepared by the Federation of British Industries," and, according to the foreword, by H. R. H. The Prince of Wales, it constitutes "an Imperial stock-taking." The scope of the work is clearly indicated in a general introduction by the Right Hon. Sir Eric Geddes, who states that throughout the aim has been to present easily accessible information regarding the quantity and quality of available supplies of the world's raw materials, the extent of undeveloped imperial resources, the facilities for transport, the conditions of local labour, and the chances of present supplies suitable for import into Great Britain being absorbed in the near future by local demands. Although complete information cannot in every case at present be given, this very fact is perhaps the best justification for the series, for it shows the necessity for careful collection and publication of relevant data, so that future issues may furnish a complete standard work of reference which should be indispensable to those concerned in imperial commerce and development, whether student, business man or administrator.

The date of publication of the series coincides with the revival in interest in Empire trade which occasioned the presentation of the Great Exhibition at Wembley, and it marks the firm establishment of scientific method in combining knowledge with organization, to the end that progress may become more rapid as accurate deduction from trustworthy data becomes possible.

As regards the tropics, Sir Eric Geddes points out that the purchasing power of our tropical territories depends mainly on the steady development of their material resources, and that this implies recourse to British capital if Great Britain is to get the greatest advantage from the development, and if our Imperial ideal is to be fulfilled. Only by the ready accessibility of reliable and comprehensive knowledge of local conditions and resources can the capitalist's interest in our tropical countries be attracted, and the series of volumes before us should certainly supply much of this knowledge and, by the fact that the majority of the volumes contains an adequate bibliography, the sources where further details may be learned can readily be tracked.

—— F. HARDY.

"ISLANDS," by Sir Arthur Shipley, G.B.E., F.R.S., Master of Christ's College, Cambridge, and Chairman of the Governing Body of the Imperial College of Tropical Agriculture. London: Martin, Hopkinson & Co., Ltd., pp. xii + 134, 26 illustrations. Price 6*s*. net.

A new book by Sir Arthur Shipley is an event of considerable importance to his many admirers and the appearance of "Islands" is none the less welcome on account of the fact that a number of the articles have already seen the light of day in the "*Times*," the "*Review of Reviews*," and "*Outward Bound*." The book concerns islands in the West and the East, in other words the West Indies and the islands of the Aegean Sea, though some qualification is necessary concerning the West Indies for the author has committed the unpardonable error of including British Guiana in a book dealing with "islands," but for this he makes ample apology in the Preface in which he states "as everybody knows, and emphatically the people of British Guiana know the only British possession in South America is anything but an island."

This fascinating book is really a record of the author's visit to the West Indies for the purpose of taking part in the laying of the foundation stone of the new building of the Imperial College of Tropical Agriculture and of a subsequent trip to the Aegean Sea in the yacht of his friend Mr. J. Pierpont Morgan.

It is towards the Western and earlier portion of this book that our readers will naturally gravitate and in this section the College bulks large. Those who travel in Sir Arthur's delightful company through these earlier chapters will be carried by their own momentum through the later chapters which, in their sphere, are as highly entertaining as those concerning the West Indies. The present reviewer has no intention of committing the error of dilating upon the many "gems" which scintillate within the covers of the book but heartily commends every reader of this brief review to secure possession of a copy at the earliest possible moment in the confident anticipation that those who begin at page 1 will close the book *only* when they have reached page 134.

Serious students will perhaps regret that that profundity of knowledge of which Sir Arthur is the happy possessor has not been allowed greater scope, and yet on the other hand the writer's facile pen has the merit of compelling interest in subjects which the lay mind normally shuns and on that score alone, we of the College, are particularly grateful.

C. Y. SHEPHARD.

" COTTON IN AUSTRALIA :—The possibilities and limitations of Australia as a cotton growing country," by Richard Harding, with many illustrations and graphs, Longmans, Green & Co., London, 270 pp. Price 12/6 net.

This book is devoted to a survey of the possibilities and limitations of Australia as a cotton growing country, and, with regard to the world shortage of cotton, " the inference drawn is that no continent or country is so favourably situated for making good this shortage as Australia." It is not an easy task to review a book of this kind. The author is neither a botanist nor a plant physiologist nor an agricultural meteorologist. This does not deter him, however, from wading boldly into specialised branches of science, and generalising often illegitimately from data drawn uncritically therefrom. Where the author quotes from or gives a precis of the opinions of an authority such as Dr. W. L. Balls, he naturally does not go far wrong. There is, unfortunately, a large mass of ill-considered and poor writing on cotton and to sift the wheat from the chaff is difficult even for a specialised scientific worker. For the man who is not a specialist it is still more difficult.

Let us consider one or two examples. In chapter 8 the author goes into the subject of soils and soil analyses. He deals with the formation of soils, the composition of rocks, sedimentary, metamorphic, and igneous, and then proceeds to give analyses of American, Egyptian, and Australian cotton soils. He finally states that " the soil analyses given in this chapter clearly demonstrate the general fertility of the soils met with throughout the cotton belts of New South Wales and Queensland." If these Australian analyses are compared with those given for Egyptian and American soils, it will be seen that not only are the Australian soils well up to the standard but that in a great many instances they are appreciably richer in plant food than those of either of the two latter countries. The figures speak for themselves and should dispel any doubts as to the suitability of Australian soils for the production of cotton.

As Hoagland points out, the idea " that from a chemical analysis of a sample of soil, reliable indication may be obtained concerning the productivity, or crop adaptation of the area which the sample is supposed to represent. .is erroneous." It is beyond doubt that the soil analyses given in the chapter are of negligible value for the purpose the writer has in mind.

In his chapter on control of seed supply the author makes the following statement :—" There is nothing difficult in the production or isolation of a pure strain and there is no mystery connected with it. It may almost be said that neither great skill nor any great knowledge of botanical science is required."

The author might be advised to isolate a few pure lines of cotton himself to see how easy it is. In point of fact it is extremely difficult and demands a knowledge not only of botany and genetics, but of statistics, plus an ability to apply the principles of these subjects, which is not commonly found. It can be said furthermore and without fear of contradiction that pure lines in cotton have never been clearly demonstrated and probably have never been obtained.

On the question of ratooning, the views of the author are very definite. He is dead against the practice in Australia, and in support of his argument cites the example of a certain West Indian Island, the cotton from which was found to be so markedly inferior to that of others in the same locality that the British Government refused to purchase it for the manufacture of aeroplane or balloon fabrics. The author says " fuller investigation brought to light the fact that this island was cultivating the Sea Island variety as a ratoon or perennial plant." The real trouble had, as a matter of fact, nothing to do with ratooning. The seed supply of the island had become contaminated by natural hybrids of Sea Island by West Indian native, with consequent deterioration of the staple. There is a good case against ratooning in Australia, but it is not strengthened by this example.

Nearly a third of the book is devoted to a discussion of the climate and rainfall of potential cotton areas in Australia. The meteorological data presented are of great interest but one needs only to take the example of St. Vincent, which produces the best cotton in the world under a rainfall of 60-110 inches per annum, to realise that the question whether a district will or will not grow cotton can at present be settled only by experiment, meteorological data being of value in so far as they supplement observations on crop physiology.

The book is well got up, and there are only a few typographical errors, but the reviewer is of the opinion that the range of subjects covered by the book is too great to be dealt with by a single writer. Nevertheless it is a book which students of cotton ought not to ignore, as it contains a good deal of information not to be found elsewhere.

S. C. HARLAND.

AGRICULTURAL IMPLEMENTS.

WE have to thank Messrs. Ransomes, Sims and Jefferies, Ltd., of Ipswich, England, for sending us a beautifully illustrated catalogue of their well-known ploughs and agricultural implements specially designed for use in the cultivation of sugar, cotton and tobacco crops. The series of ploughs made by this firm includes several sturdy types that have given highly satisfactory results in breaking up new soil, and in deep work such as is frequently desired in dealing with sugar-cane clay lands. Certain of these types have long been used in the British West Indies, notably in British Guiana, where the demands are often particularly strenuous.

CORRESPONDENCE.

Dear Dr. Leake,

I was very much interested in your review of the work by L. C. A. Knowles on the economic development of the British Overseas Empire.

I note one sentence as follows: "It is possible to proceed too fast in these directions. The primary object should be to make the native a diligent worker rather than to feed him with ideas." That is particularly good and applies to the people of Haiti. What we need here is development of productivity. The people should be taught how to work rather than how to be scholars.

We are therefore emphasising the arts rather than the classics, and in teaching the rural population how better to plant, cultivate and harvest their crops and to feed and care for their poultry and livestock.

The only classical education that we give in the rural schools are the simpler elements of reading, writing and arithmetic. All the remainder of the time is devoted to agriculture. Likewise, in the vocational schools in the towns, we are emphasising the trades. First, with the idea of making trained workers of the greater masses and skilled mechanics in sufficient number, and a few engineers to take care of the more technical points of government and industrial work.

Our work here is going on fine. Buildings are now under construction. This year we are putting up a $50,000 wing of the main building of the Agricultural College and seven or eight smaller structures consisting of barns, shop building, veterinary laboratory, &c. We have just had an additional appropriation bringing the total appropriation for the fiscal year 1924-25 up to $490,000.

We have our technical staff of Americans complete with the exception of a horticulturist. I am looking for a man and am willing to pay as much as $5,000 to get one having good training and tropical experience, but practically a year's search has so far failed to uncover a man fulfilling all of these qualifications.

With best wishes, I remain,
Yours very truly,

GEO. F. FREEMAN,
Director-General.

Service Technique du Department
de L'Agriculture et de
L'Enseignement Professionnel
Port-au-Prince,
Republique D'Haiti.

[The review referred to appeared in *Vol. II, No. I of the Journal* (January 1925). The statement regarding education in the tropics, a highly controversial subject, demands respect. It will be noted that the total appropriation for the fiscal year 1924-25 amounts to no less than $490,000, while a considerable sum has been allocated to the construction of buildings. It is interesting to note that the Imperial College of Tropical Agriculture is endeavouring to secure £100,000 from the British Empire as an endowment fund.]

COLLEGE NEWS.

THE Principal left Trinidad for England on March 3rd, by the *s.s. Stuyvesant*, in connection with official duties. During his absence Professor Ballou will act as Principal and Imperial Commissioner.

Professor Farmer, Governor of the Imperial College of Tropical Agriculture, and member of the Executive Committee of the Empire Cotton Growing Association, and Mr. Kilby, Secretary of the Empire Cotton Growing Association, having concluded their investigations into the possibility and advisability of establishing a cotton research station in Trinidad, left for England by the *s.s. Stuyvesant* on March 3rd, to present their report.

With this issue of "*Tropical Agriculture*" we publish a supplement on the Experimental and Instructional Sugar Factory of the Imperial College of Tropical Agriculture, containing articles on its History by C. Y. Shephard, B.Sc. (Econ.), the College Course in Sugar Technology and a Description of the Machinery by Professor O. F. Boyd, B.A. (University of La.), and the first list of Presentations. The prints are published by kind permission of the West India Committee.

During the past month, the Department of Agronomy arranged several excursions to outlying centres. On February 25, third year students were given an opportunity of looking over the meteorological station maintained by the Trinidad Department of Agriculture. On March 2, first year and post-graduates, through the courtesy of Mr. R. O. Williams, Superintendent, were conducted over the nurseries at St. Clair. On March 4, second year and post-graduates journeyed to River Estate, where the various phases of cacao production were seen under the careful guidance of Mr. O'Connor, manager of the estate. On March 7, a party of 26, including the Professor of Agronomy and the Reader in Economics, visited the Usine Ste. Madeleine. On leaving the train at San Fernando, the party was taken by cars and bus—kindly provided by the Usine—first to the factory and conducted over the whole plant by Mr. Scott, chemist, and the factory manager. The mill work was particularly striking, many of the students seeing a Searby shredder in operation for the first time. The excursionists were next delightfully entertained to lunch at the Paramount Hotel by Mr. Skinner, the Usine general manager. Luncheon over, Professor Dash thanked Mr. Skinner for the splendid outing which had been arranged, to which the latter in replying expressed the hope that such a visit would become an annual affair. The party then set out under the guidance of Mr. Jones, Usine agronomist, to see cultivation, implements, pens, &c. Holt tractors and Killefer subsoiling tools were of special interest. (See *Tropical Agriculture* Vol. I, No. 7, p. 109.) These excursions are much appreciated and the thanks of the Department and the College are due to all who assisted in any way towards making them a success.

TREND OF THE MARKETS.

[The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.]

SUGAR.—The year 1925 promises to be a momentous one in the history of this industry as both supply and demand are above the average and beet is challenging cane in a remarkable way. Before the war prices for beet and cane were in the proportion of 7 to 10, but is now 5 to 10. Cane sugar continues to be a weak market, cubes being at 36*s*. 3*d*., West Indian Crystallised 28*s*. 9*d*. and Muscovado 25*s*. each per cwt. duty paid London on February 11th. Common granulated beet fetched 16*s*. 3*d*. per cwt., duty paid on the same date.

COTTON.—Prices declined further to 12·70*d*. per lb. for Middling American spot, London on January 27th. The strong under current of strength, recently noted, then asserted itself and prices recovered rapidly, reaching 13·70*d*. on February 12th. The rapid way in which cotton has come "into sight" would apparently have indicated a glut but the world is still hungry for cotton and the recent rise in prices is not without its significance.

CACAO.—Cacao prices seem to have taken a turn in buyers' favour. Accra fermented was offered at 38*s*. 9*d*. per cwt., on February 11th as against January's closing price of 48*s*. per cwt. Trinidad Mid. Red declined to 82*s*. 6*d*., per cwt. while Ceylon ordinary fetched 110*s*. per cwt.

COFFEE.—Coffee generally suffered a slight decline after January 7th, but has since shown a tendency to rise. Costa Rica Middling sold easily at the comparatively high price of 180*s*. per cwt. on February 11th. East Indian Mysore Middling after rising to 168*s*. per cwt. on February 4th later declined to 162*s*. on February 11th. Kenya good Middling fell to 154*s*., while Brazil Santos realised 126*s*.

TEA.—All kinds of Tea have suffered a considerable decline. On February 11th, Ceylon averaged 20·22*d*., Indian 19·05*d*., and Java 13·50*d*. each per lb. A considerable quantity of very poor quality Java tea has been disposed of and this accounts for the comparatively heavy fall in prices.

SISAL AND HEMP.—The Market for sisal and hemp is by no means as good as a month ago. Manila Hemp fell to £51 10*s*. on February 11th and Prime Sisal after falling to £46 10*s*. on January 28th subsequently showed a tendency to rise and closed at £47 per ton on February 11th.

RUBBER.—Plantation crepe, which averaged 18·15*d*. per lb. from January 1st to 7th dropped to 17·20*d*. per lb. from February 2nd to 11th. Stocks in London amounted to only 27,085 tons, a very manageable quantity.

RICE.—After a brief rise to 18*s*. 6*d*. per cwt. for old crop Burmese rice, prices again closed at 18*s*. New crop rice to arrive in May can be secured at 14*s*. 6*d*. Carolina rice after rising to 37*s*. per cwt. closed at 36*s*. on February 11th. The trade complains that high prices check demand.

COPRA.—Prices for copra have been irregular. Sun dried Straits to Rotterdam selling at £29 10*s*. on February 11th and Ceylon £30 17*s*. 6*d*. Good clearances have been made but the market generally appears depressed.

OILCAKE.—Although prices are somewhat lower considerable quantities of oilcake are changing hands, Linseed oilcake closed at 13*s*. per cwt. on February 11th, Cottonseed oilcake at 7*s*. 10½*d*. and Coconut oilcake at 11*s*.

FERTILIZERS.—Fertilizers are already experiencing a Spring demand, sulphate of ammonia realises 14*s*. 6*d*., nitrate of soda 13*s*. 6*d*., sulphate of potash 11*s*. 6*d*., and muriate of potash 7*s*. 3*d*. each per cwt. London on February 11th.

PUBLICATIONS RECEIVED.

(Non Periodical.)

"IMPERIAL GAZETEER OF INDIA," in XVIII VOLUMES.

COTTON IN SOUTH AFRICA, by W. H. Scherffius, M.SC., and J. du P. Oosthuizen, M.SC.

"HANDBOOK OF THE LEEWARD ISLANDS." Compiled by Frederick Henry Watkins, I.S.O., London, West India Committee.

"SOUTHERN RHODESIA HANDBOOK." For the use of prospective settlers on the land, issued by the direction of the Hon. the Minister for Agriculture and Lands. Paper cover, pages 74.

"CONTEMPORARY PERSONALITIES." By the Right Hon. Earl of Birkenhead, P.C., D.L., with 30 Cartoons by Matt, and Photographs. Cassel & Co., Ltd., Price 21*s*. net, pages 325. Presented by the Author.

"PLANTS POISONOUS TO LIVE STOCK." By Harold C. Long, B.SC., of the Ministry of Agriculture and Fisheries; Author of "COMMON WEEDS OF THE FARM AND GARDENS." Revised. Cambridge, at the University Press, 1924.

"WHAT EVERY BRITON OUGHT TO KNOW." By Ben H. Morgan (Chairman of the British Empire Producers Organization, Vice-Chairman of the Trade and Industry Committee, Royal Colonial Institute). With a Foreword by the Rt. Hon. Stanley M. Bruce, M.C. London: P. S. King & Son, Ltd., Orchard House, 2 and 4, Great Smith Street, Westminster, S.W., 1. 3*s*. 6*d*. net.